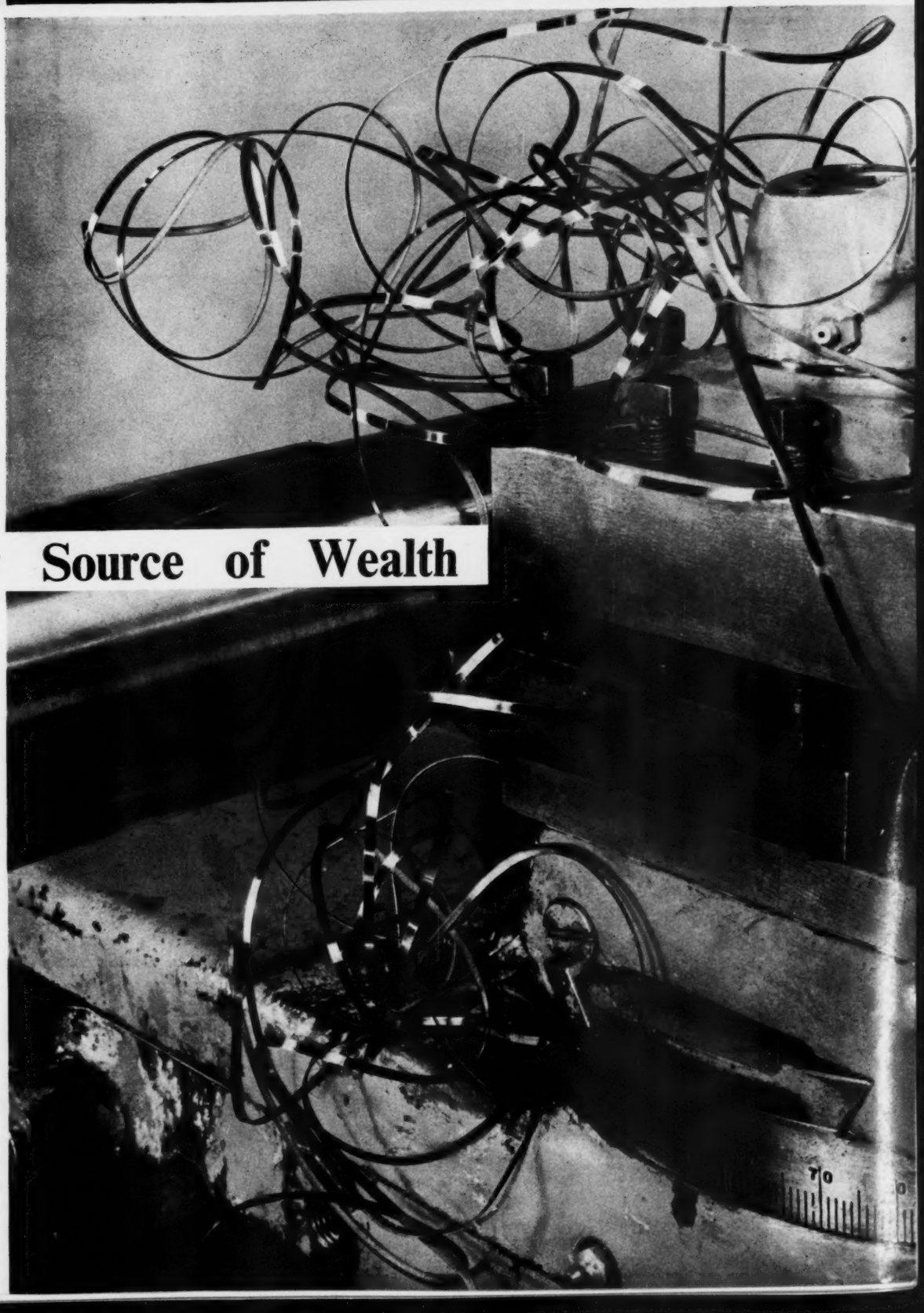
ENGINEERING



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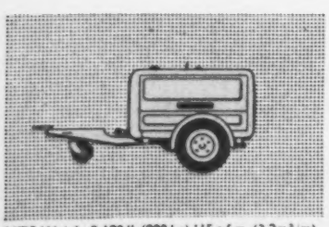
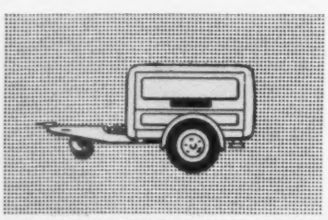
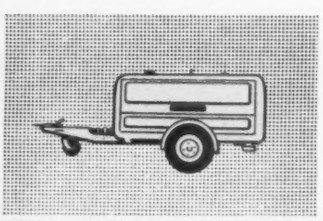


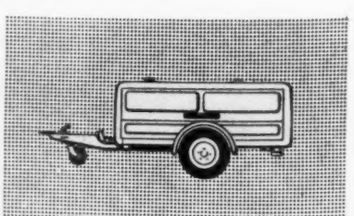
VT3 Weight 2,180 lb (990 kg) 115 c.f.m. (3.2m³/m)



VT4 Weight 2,310 lb (1050 kg) 160 c.f.m. (4.5m³/m)

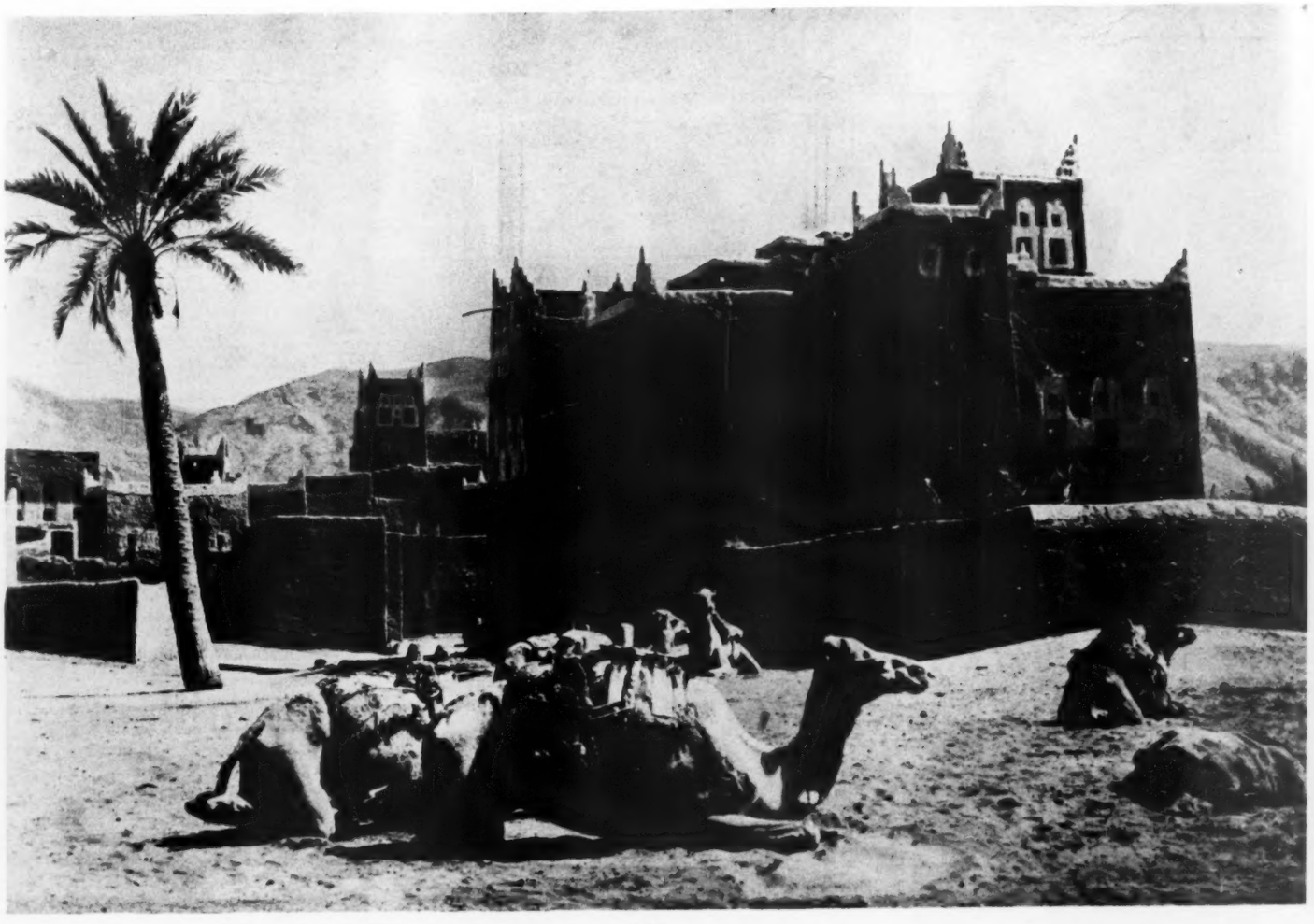


VT5 Weight 2,900 lb (1315 kg) 225 c.f.m. (6.4m³/m)



VT6 Weight 3,590 lb (1630 kg) 315 c.f.m. (8.9m³/m)

PCR1



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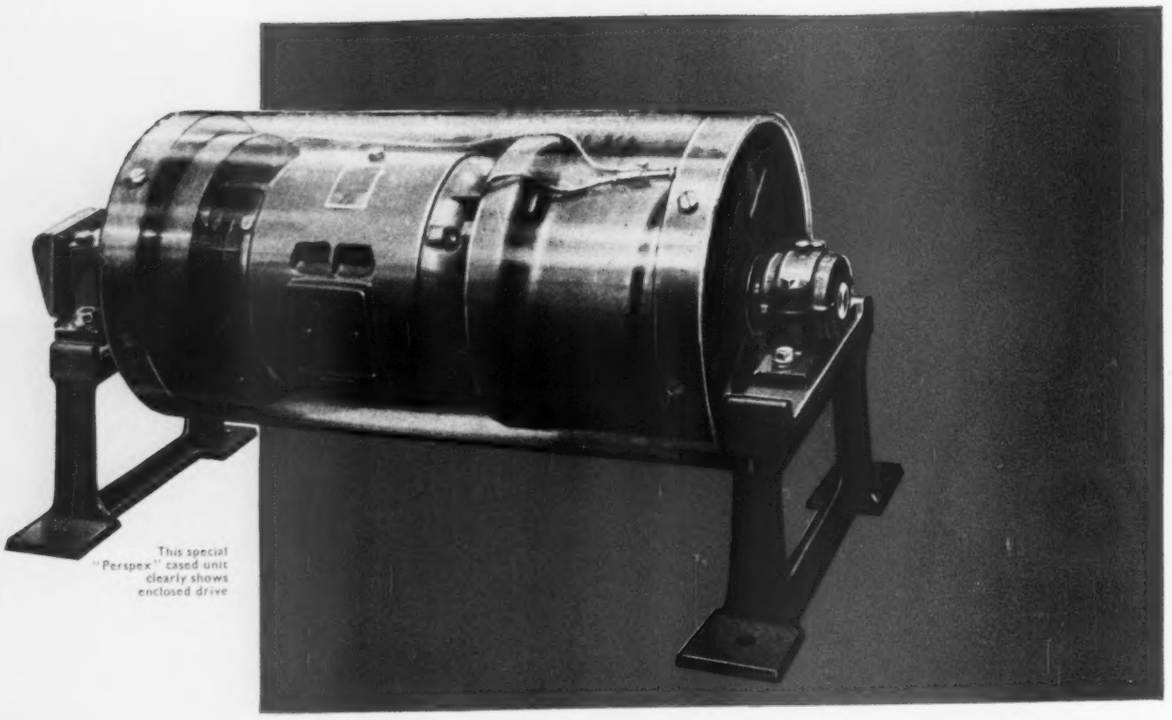

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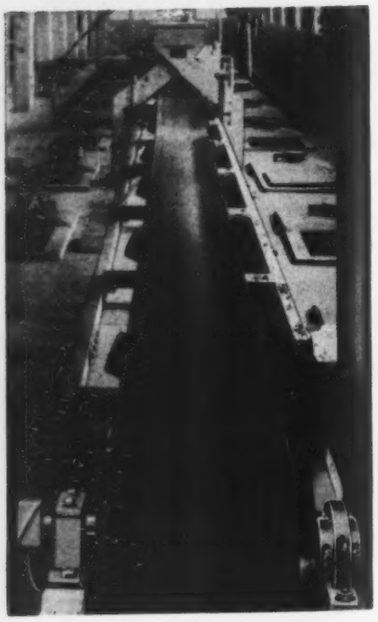

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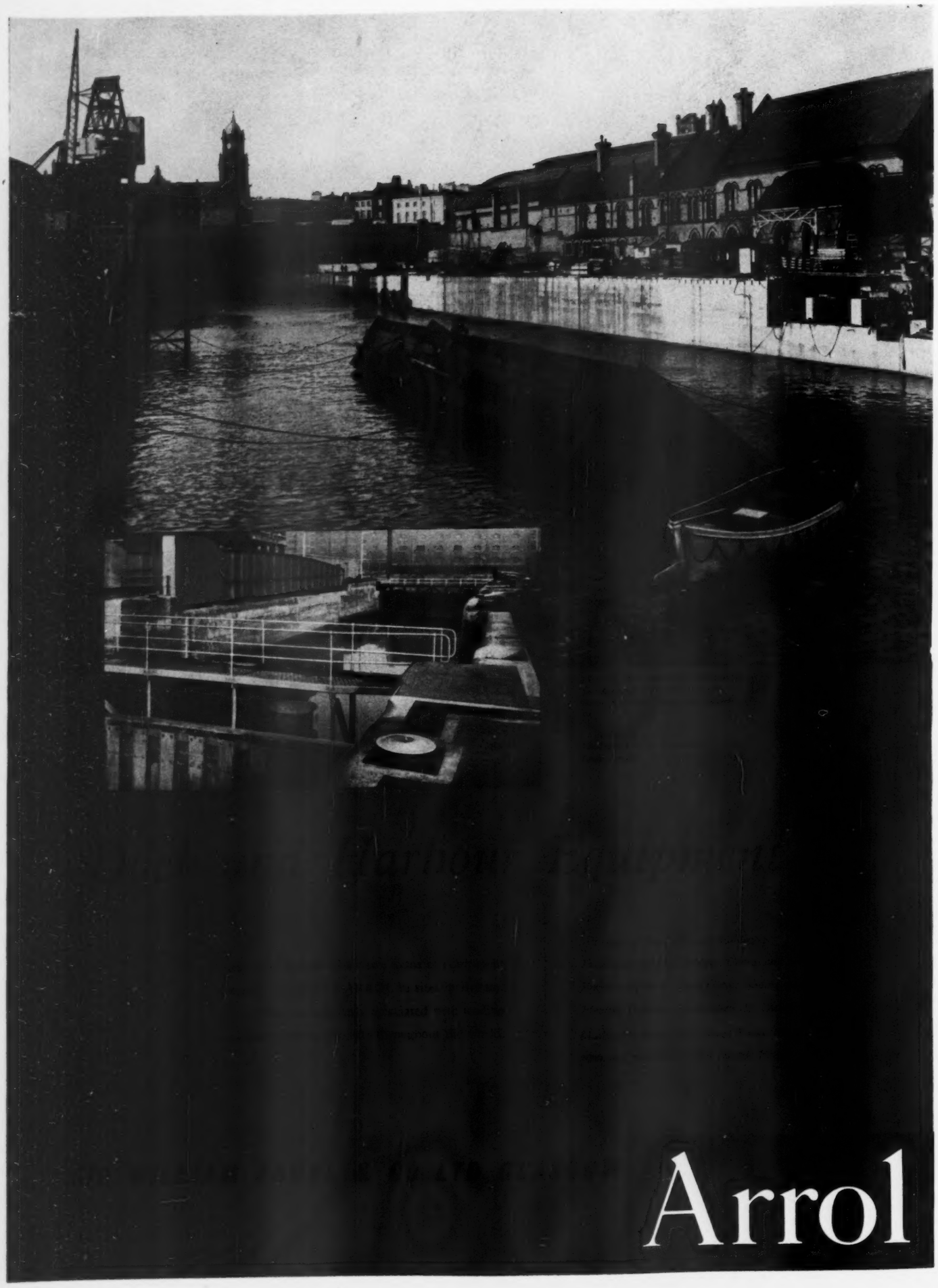
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21 October 1960

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Founded in 1866

ENGINEERING

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Turning metal on a lathe produces, besides the component, chips and swarf. One way of reducing this particular example of waste is by the new non-chip metal forming processes that are now coming into use

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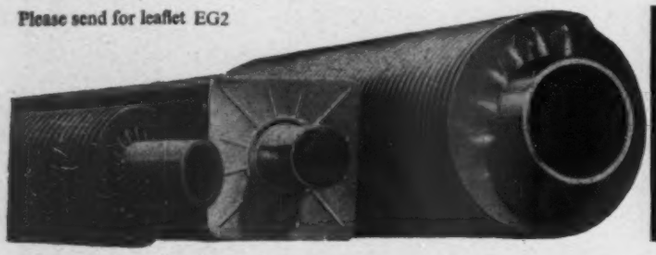

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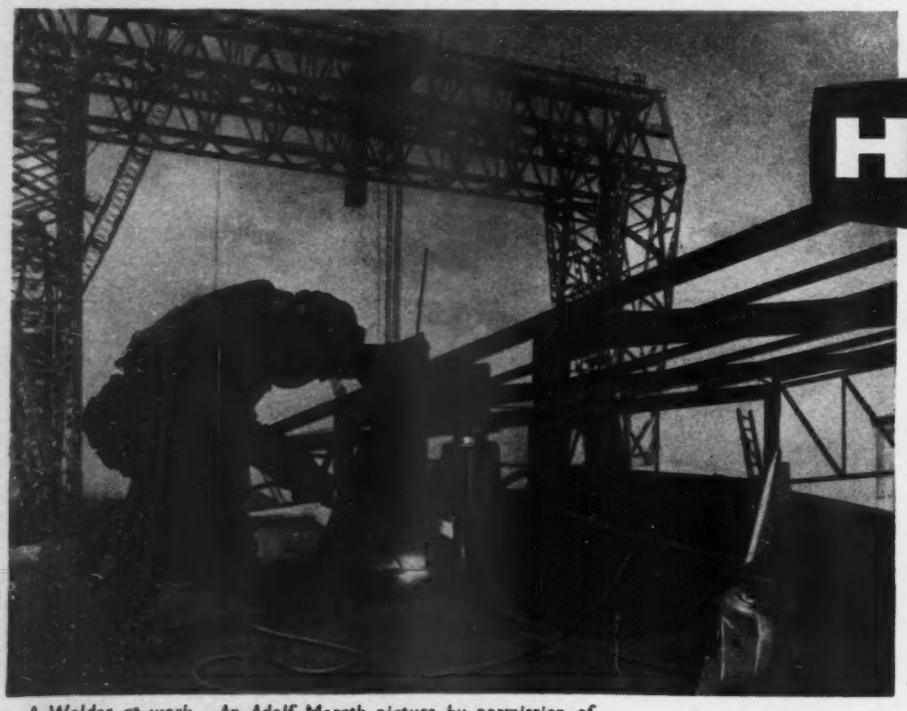

A Welder at work. An Adolf Morath picture by permission of Bradwell Nuclear Power Station and The Nuclear Power Group.

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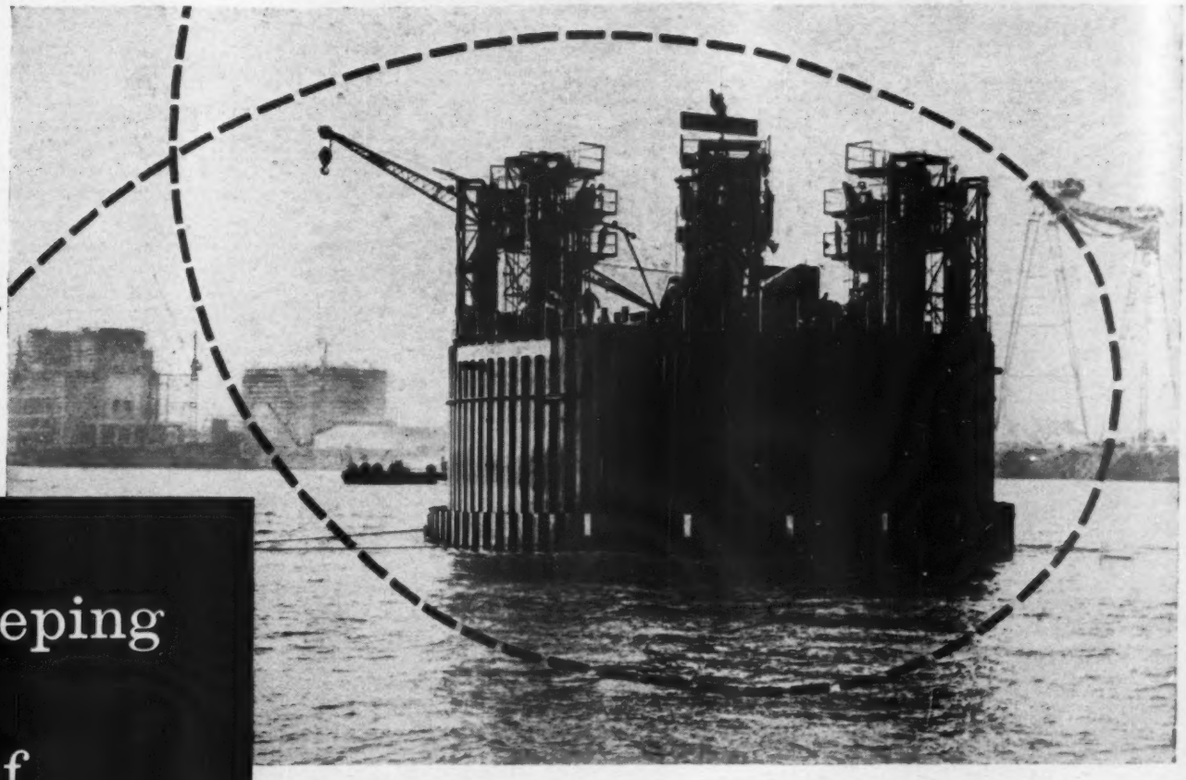

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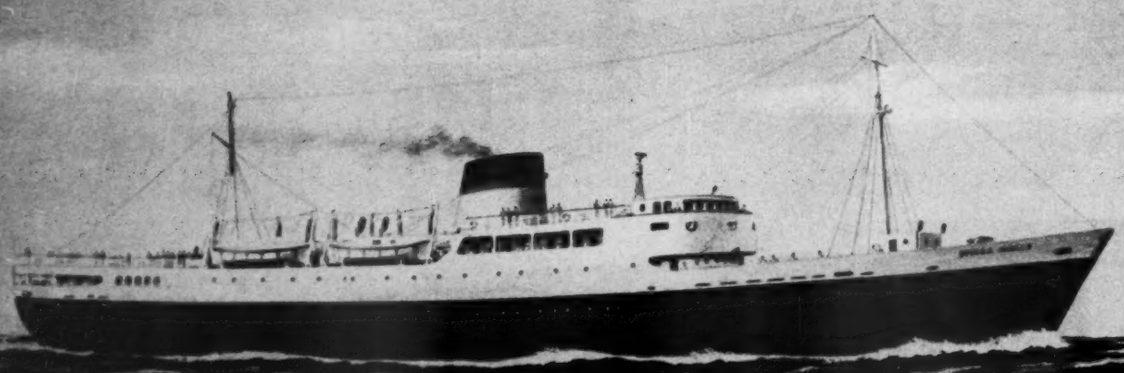

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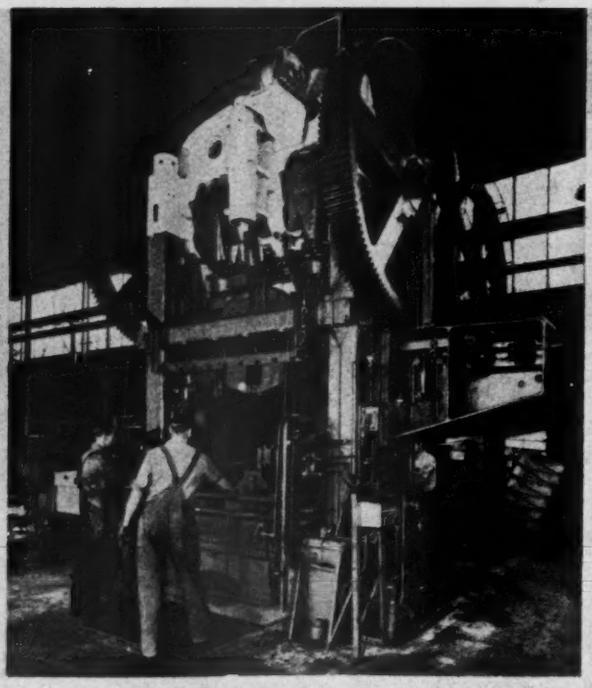

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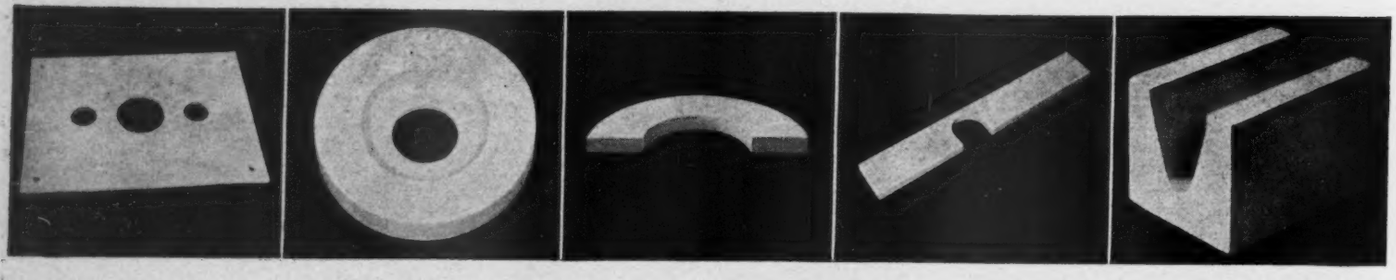

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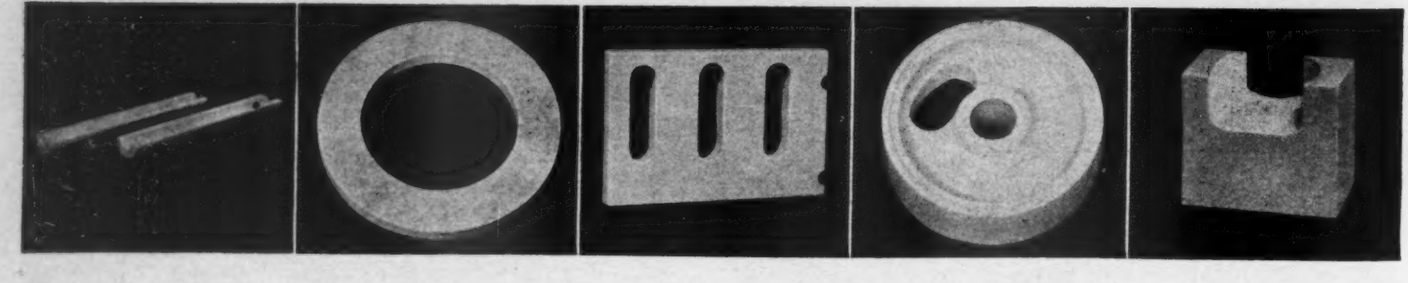

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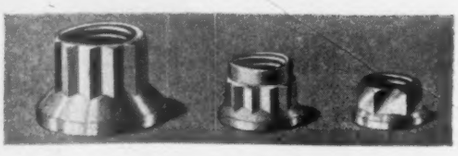

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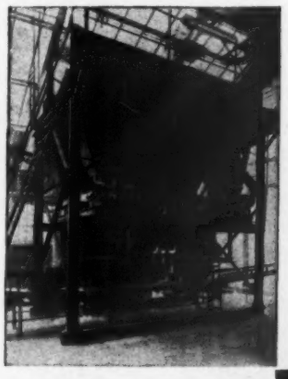

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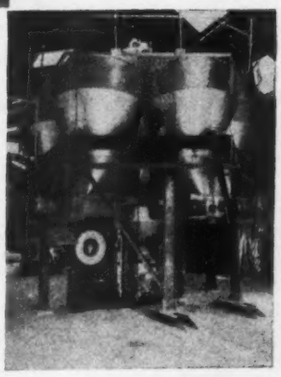

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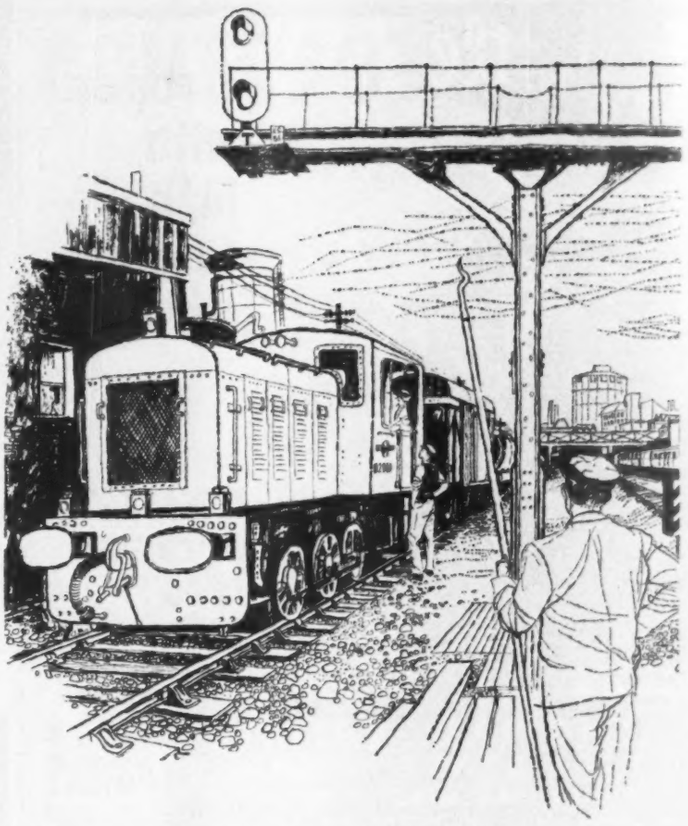

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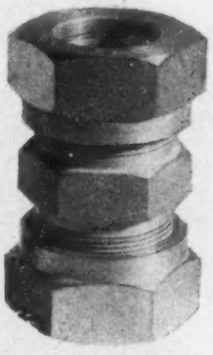

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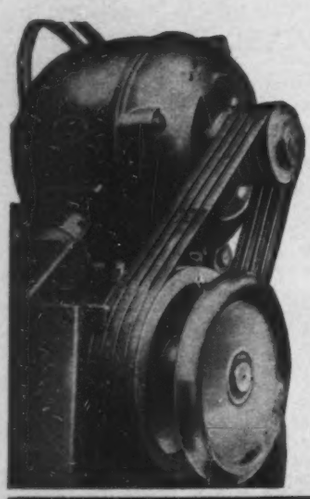

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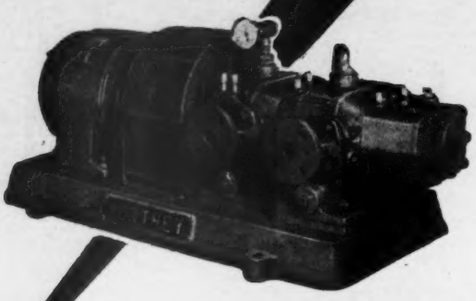

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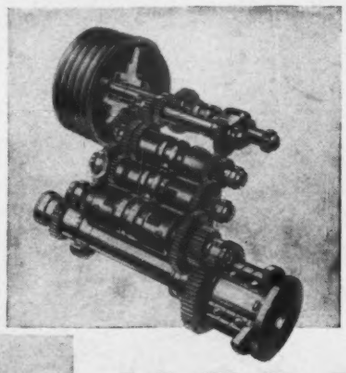

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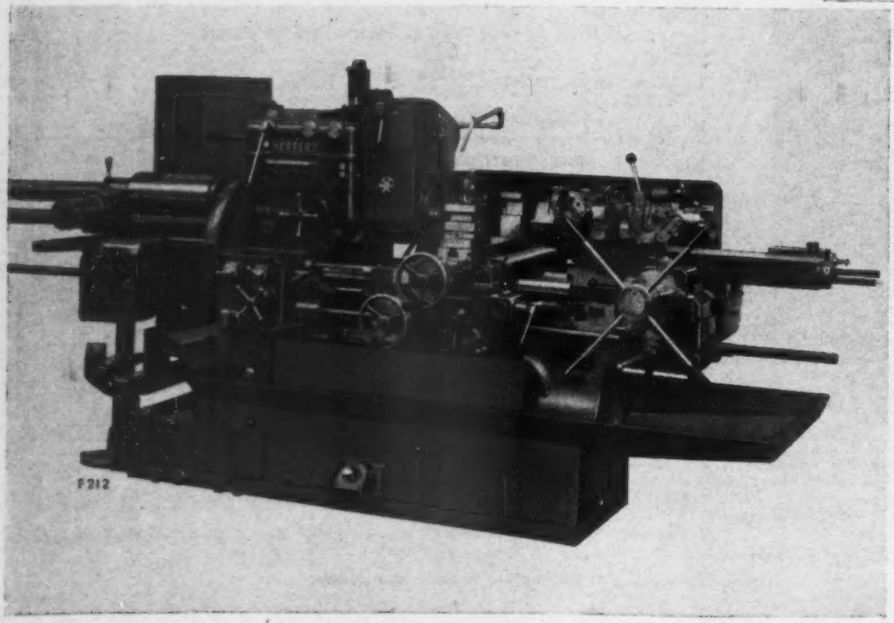

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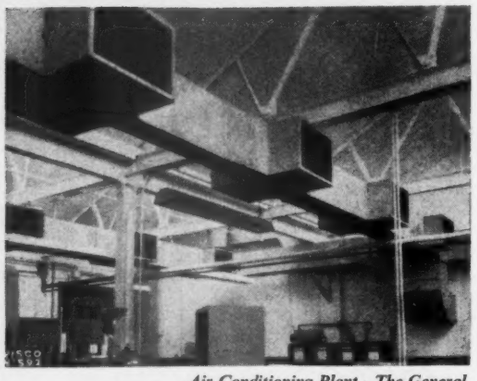

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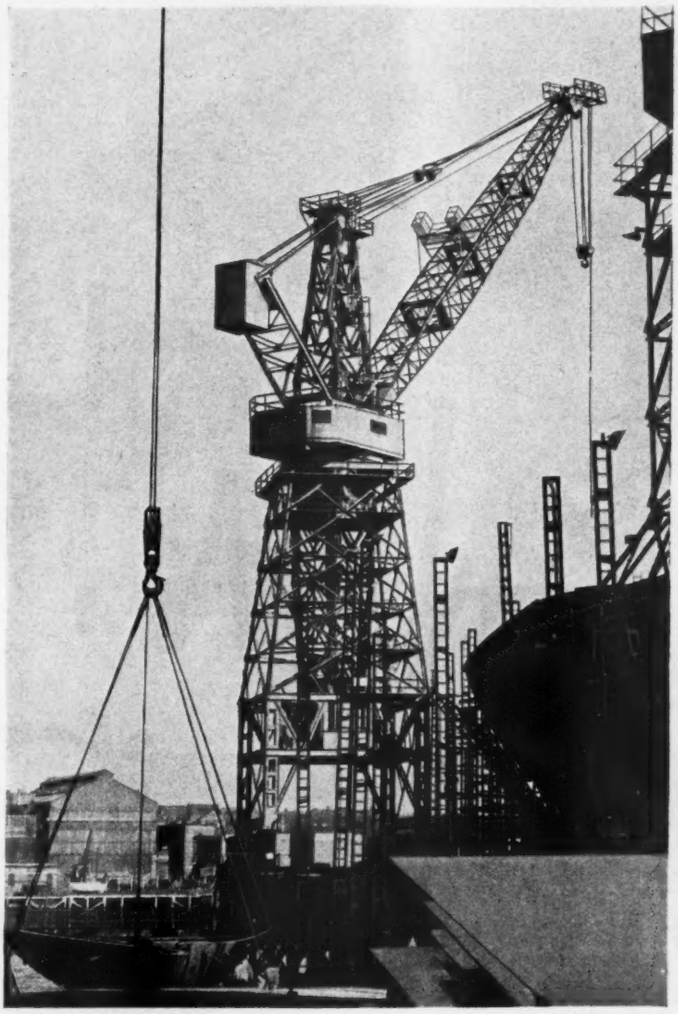

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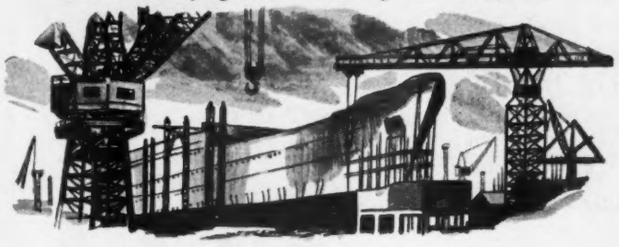

The 35 tons capacity crane illustrated is installed at the Hebburn yard of Messrs. Hawthorn Leslie (Shipbuilders) Ltd., by whose kind permission this photograph is reproduced.

These semi-level luffing cranes are ideally suited to the contemporary trend towards construction in larger prefabricated sections.

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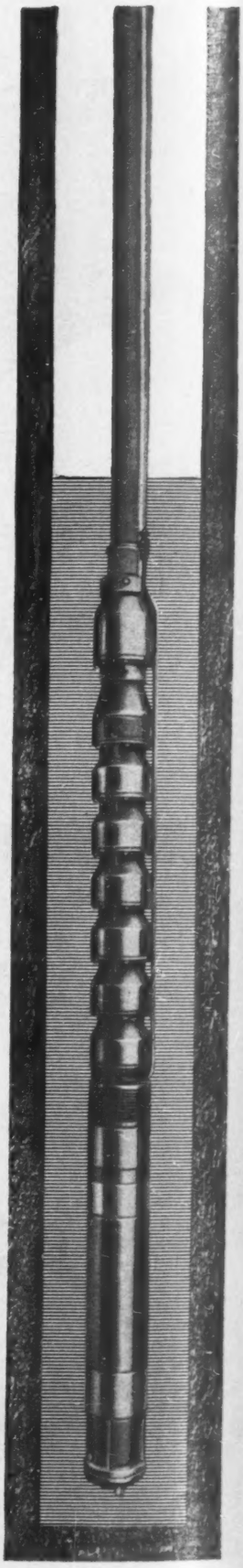

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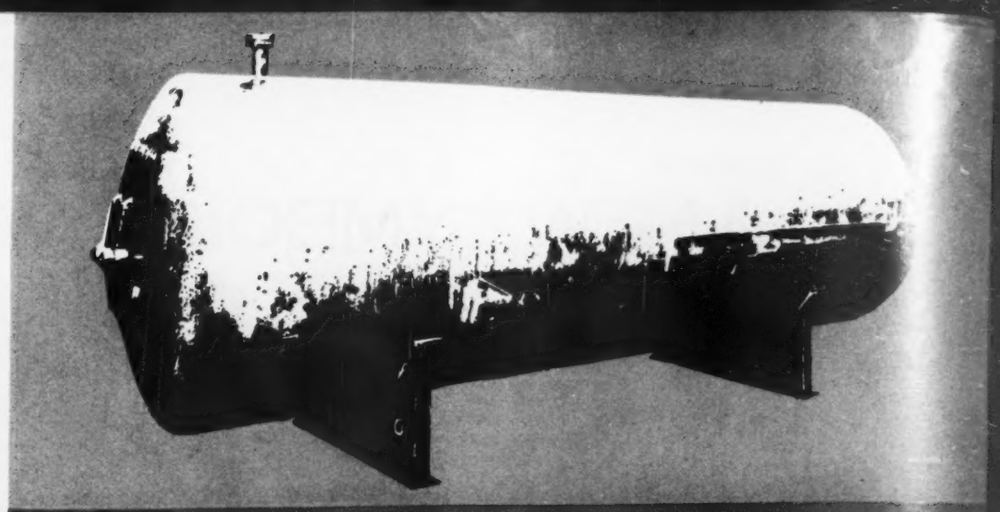

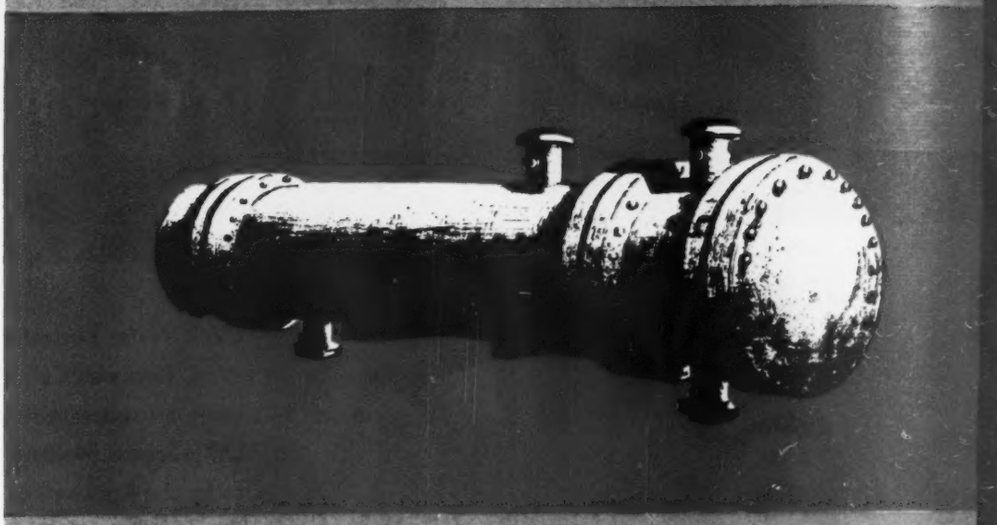

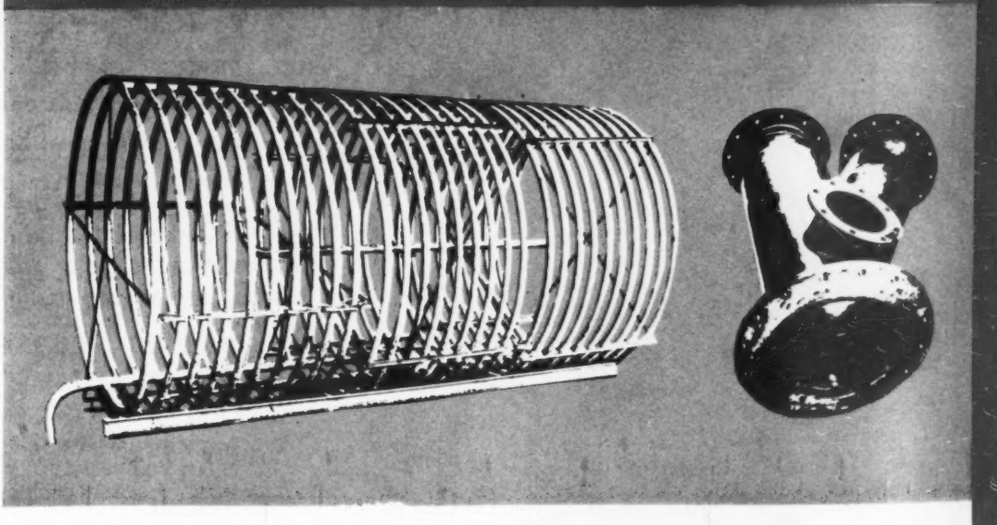

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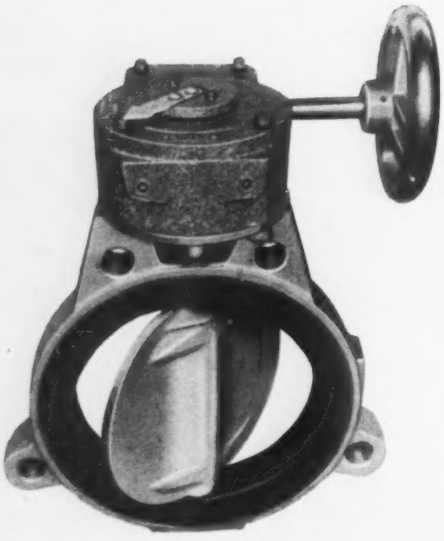

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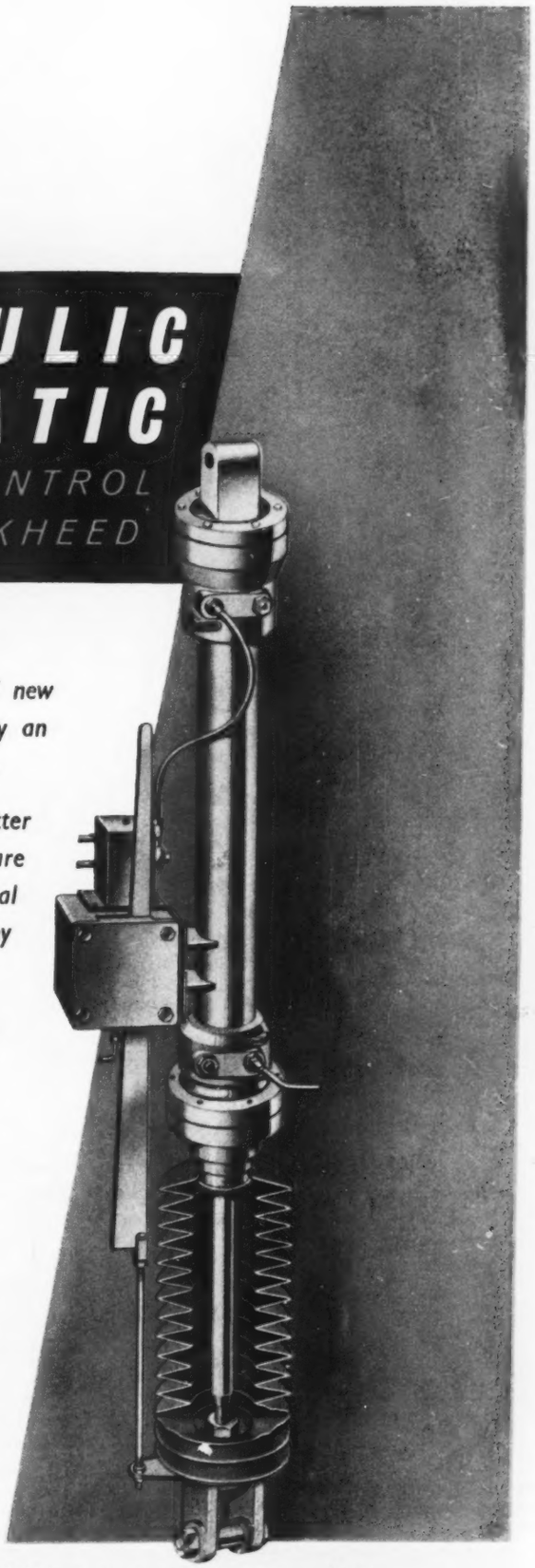

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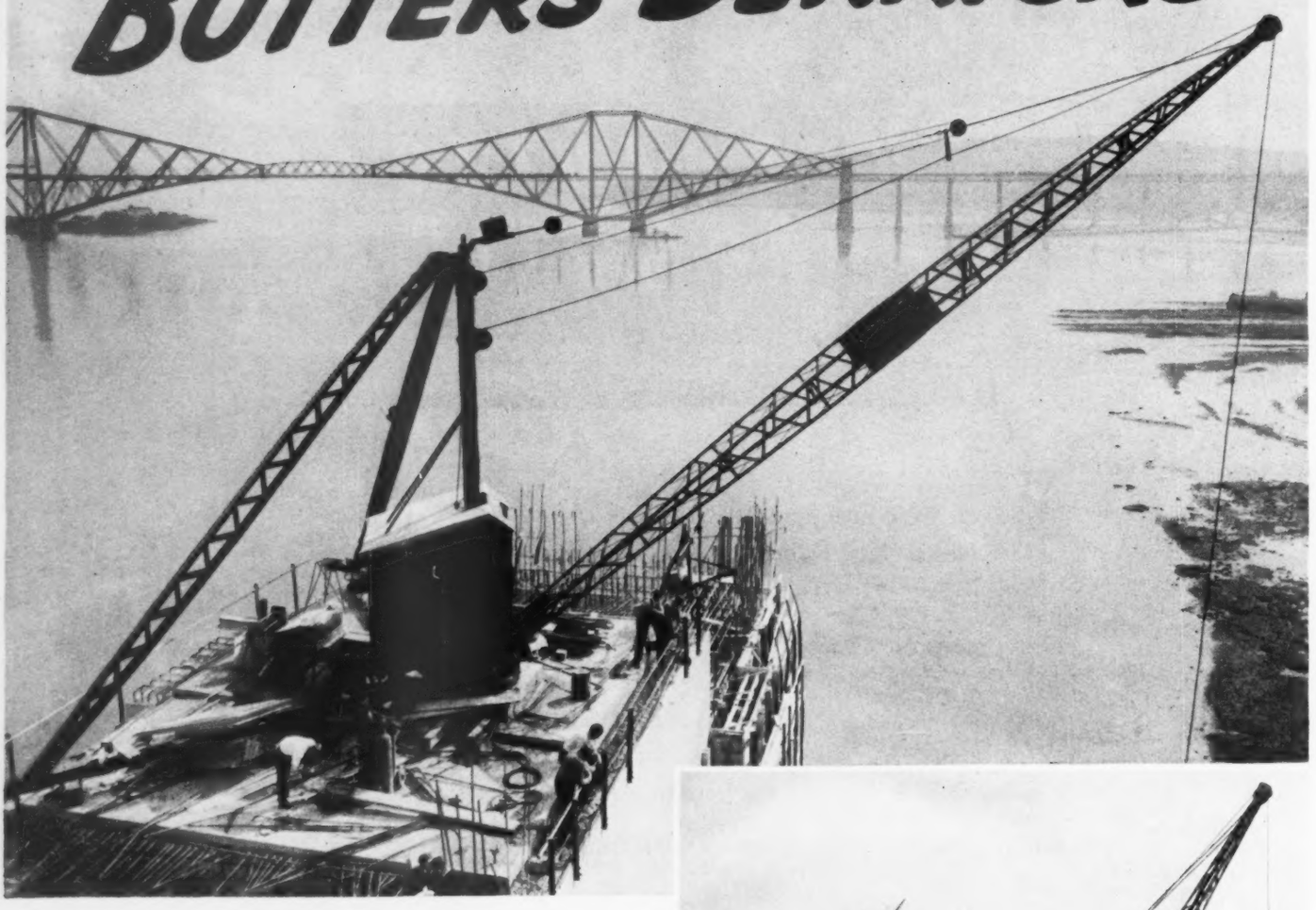

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The Laocoon Group—Vatican Museum

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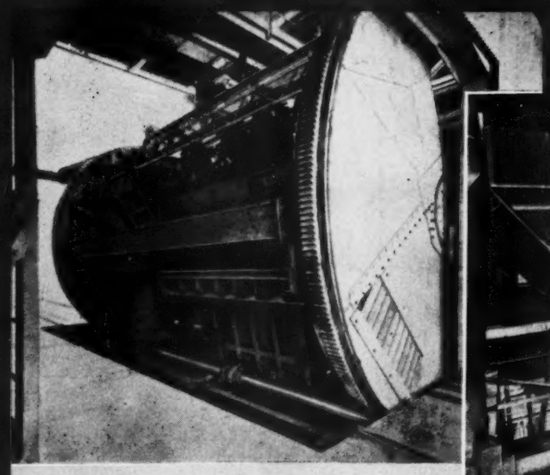
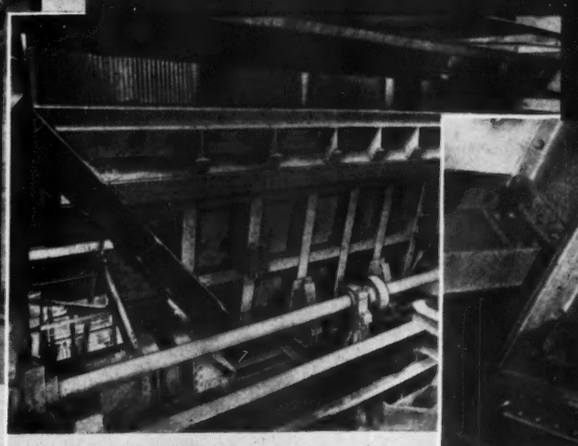
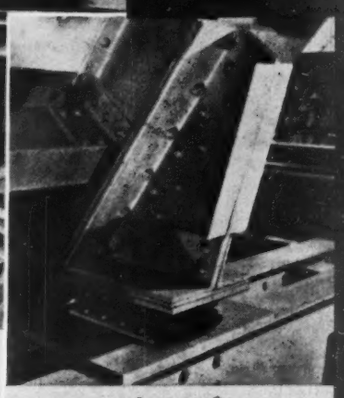


Ore is tipped out of the truck here . . .



falls into this hopper . . .

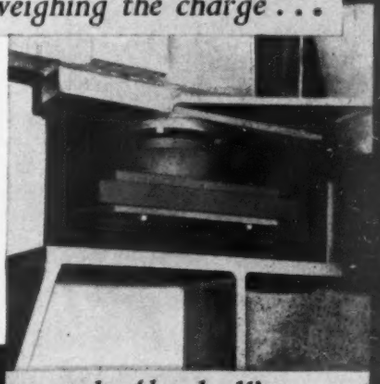


mounted on 6 Metalastik mountings.

Softening the shock loads

At the Stanton Ironworks, ore is discharged from railway wagons by means of a tippler and crashes into a hopper. Normally 25-35 tons may be discharged in 30 seconds, sometimes in a steady stream but occasionally lumps of iron ore, exceeding 3½ tons fall 10-ft., resulting in impact loads which are considerable and could be damaging. Furthermore the vibration and shock impulses—unless checked—would be transmitted to adjacent buildings and plant. Accordingly the suppliers of the plant, Mitchell Engineering Ltd. called in Metalastik to reduce the harmful effects by providing mountings which normally support 11 tons each, deflecting 0.1". Under the extreme conditions already mentioned the deflection is 0.3", making a very considerable reduction in the shock effect. A similar problem arose at Samuel Fox's works in Sheffield where a magnet crane discharges large masses of scrap metal into a 60-ton scale transfer car from a considerable height. The loadcells employed had to be safeguarded from excessive shock loads in order to maintain their high accuracy indefinitely. Davy and United Instruments Limited, who engineered the loadcell weighing equipment into the installation, met the problem by incorporating Metalastik mountings as illustrated in the accompanying pictures. Whether for a small instrument, a diesel engine or a great piece of industrial plant, Metalastik mountings can always improve the conditions.

On this transfer car for weighing the charge . . .



. . . the 'loadcell' is protected by Metalastik mountings.

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OF A
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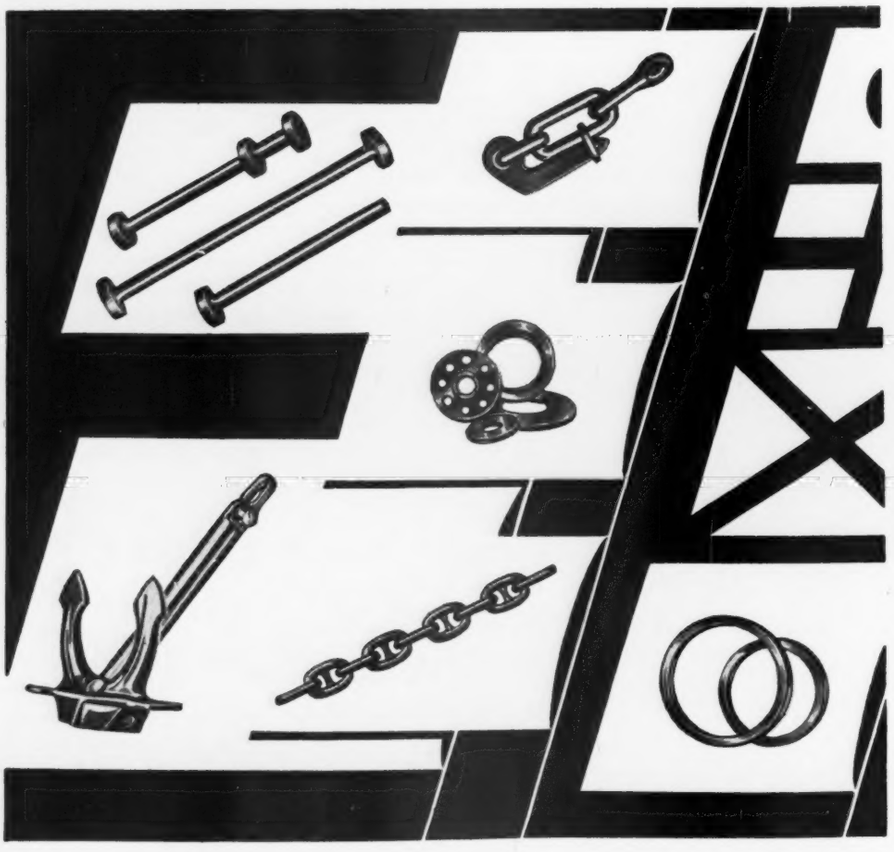

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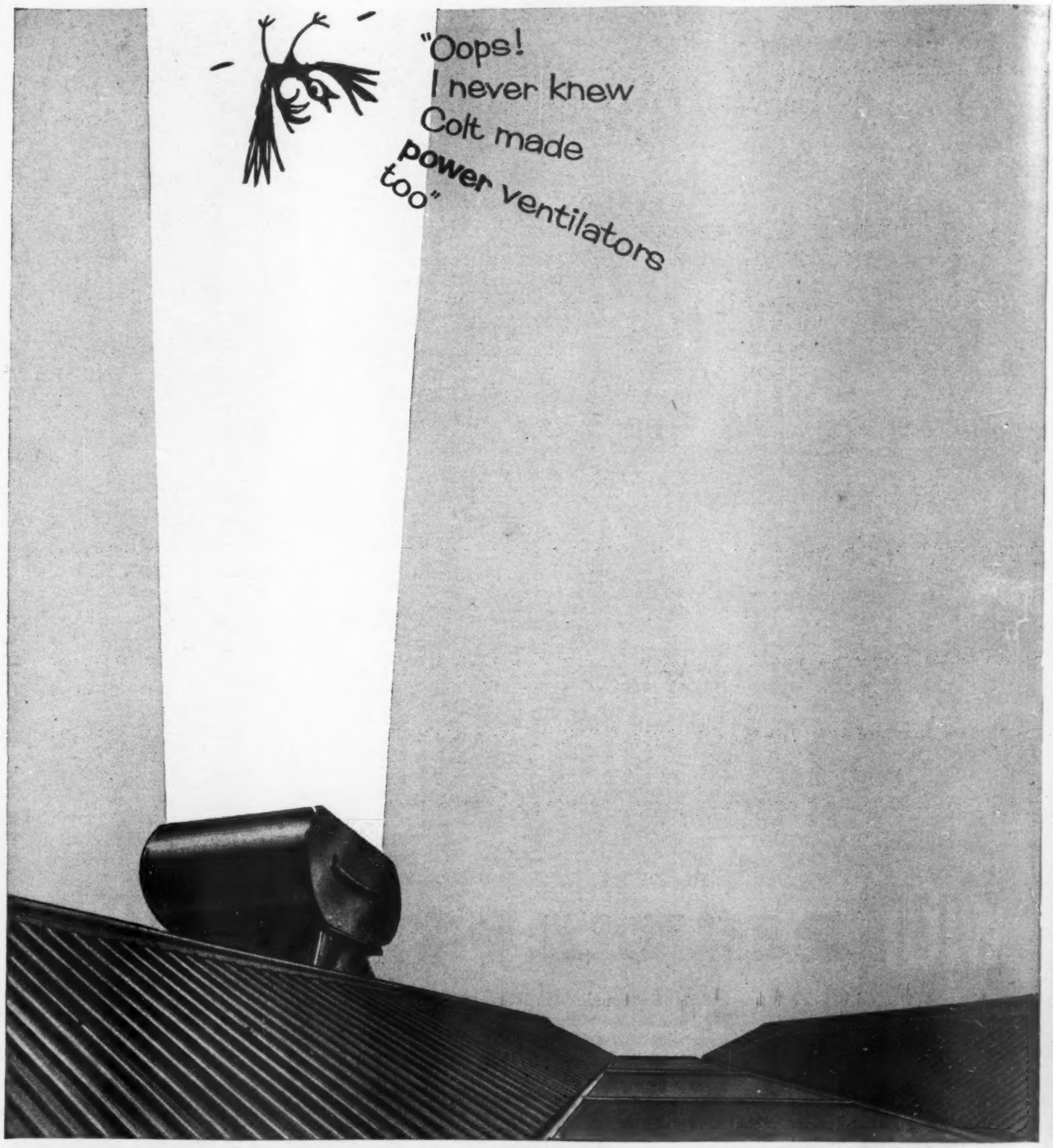

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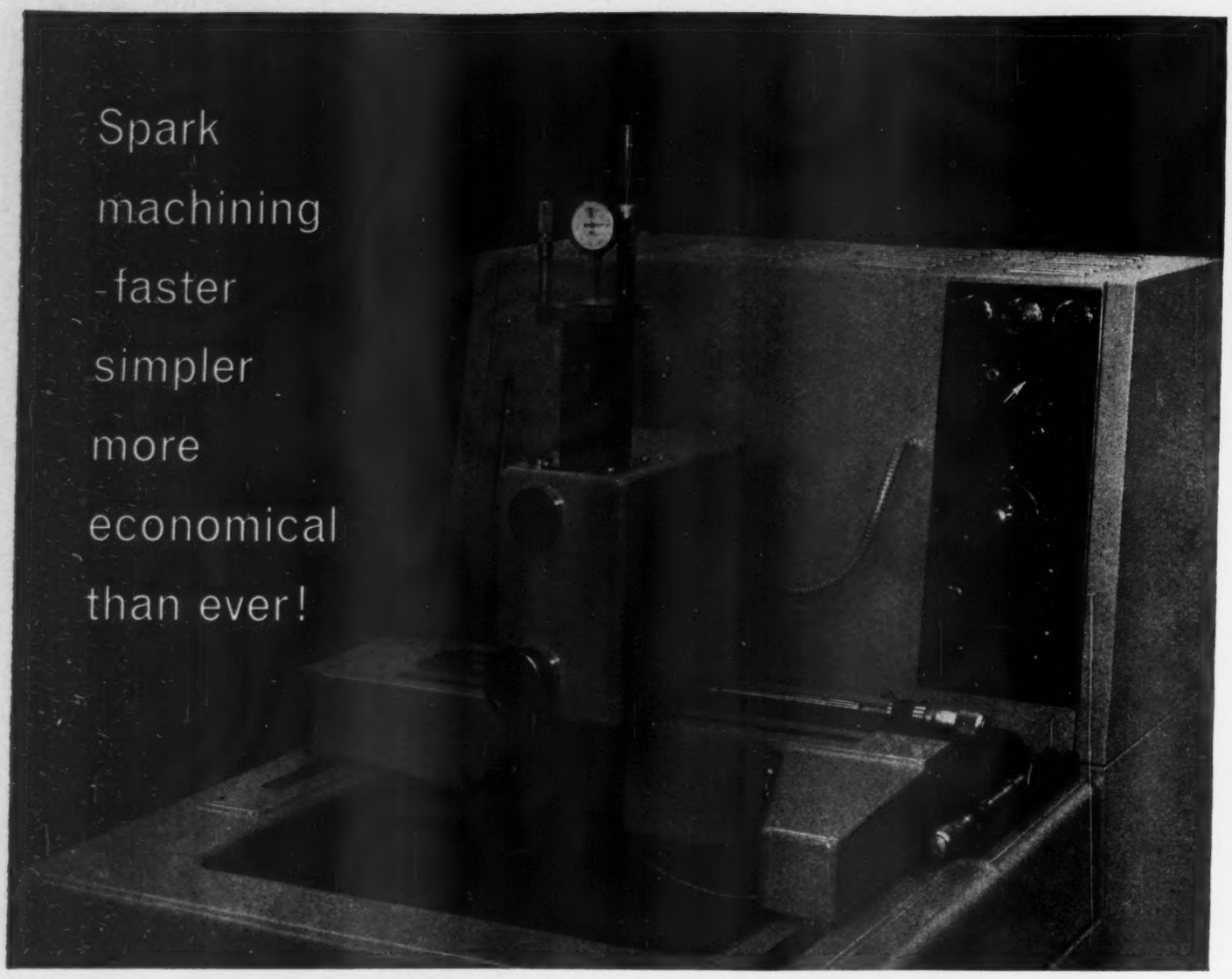

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GKN spark machine

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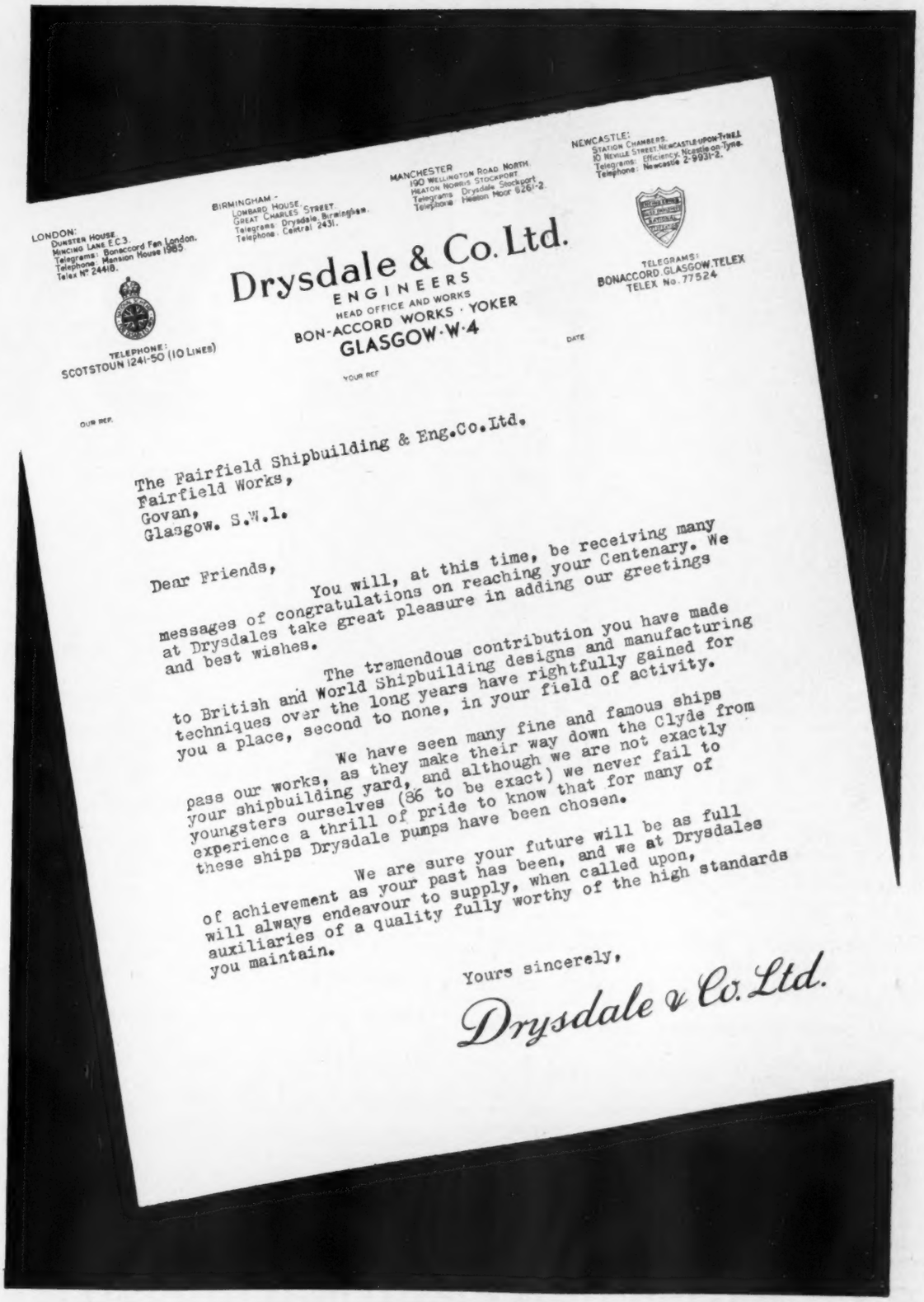

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We are sure your future will be as full of achievement as your past has been, and we at Drysdales will always endeavour to supply, when called upon, auxiliaries of a quality fully worthy of the high standards you maintain.

Yours sincerely,

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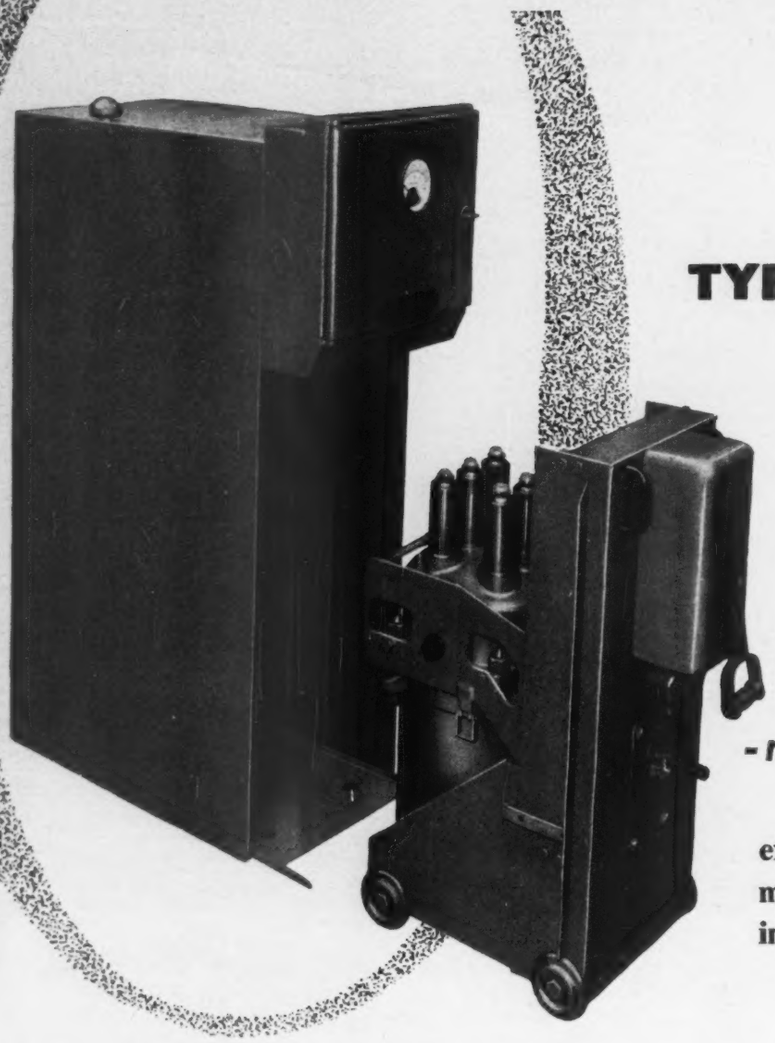

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"BV" Switchgear has a well-established reputation for 11kV service, founded on its satisfactory performance in variable climates and its adaptability to particular system or other local conditions.

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F/777

ENGINEERING Impact

of a Royal Commission on Waste Recovery

BRITAIN is a small country with a large population, and draws most of her raw materials from overseas. A more critical situation in terms of waste can scarcely be imagined. There is less space to put our refuse, more people to produce it, and no margin for extravagance with our resources.

The protest that began at Pucklechurch, the beauty spot near Bristol chosen as a rubbish tip, is bound to grow in volume and break out in unexpected places. But for industry, waste is not simply a problem of disposal—though legislation may make disposal much more difficult—but also a question of conserving precious raw materials.

Social and economic pressures will combine to make industry increasingly waste conscious, so that waste processing and recovery will form a growing sector of its operations. It may even become economic to recover materials once considered worthless.

But at present there is no comprehensive information concerning the nature and disposition of our wastes. Materials produced in quantity are simply dumped, because they are too costly to transport; but a consideration of local needs might reveal a use for them. New industries might spring up, based on waste materials which, since they represent a liability to the producer, will inevitably be cheap. One industry might need a raw material which, unknown to it, is being discarded elsewhere by another. Only by a broad survey of the situation can the best solution be discovered. The problem might even justify the creation of a Royal Commission. Already the Department of Scientific and Industrial Research are devoting considerable attention to the matter.

Embarrassment or Bonus

A Royal Commission on Waste Disposal and Recovery might recommend a full study of the subject. Only by such a study could it be judged whether wastes are a liability, or a blessing in disguise. The study would involve an overall classification of waste products in terms of location, quantity, character, value and potential.

Wastes may be divided into those that are assiduously recovered because of their intrinsic value, like sweeps and residues of precious metals, and those that are an embarrassment because of their bulk and uselessness—slag and power-station ash have long been regarded in this light, though ways of using ash for making bricks have been developed. Wastes may be recycled as scrap, the material changing its shape rather than its character; and wastes may be chemically treated to provide the raw materials for other processes.

Waste may be avoided in the very beginning by using a production process that minimises scrap; thus metal-forming is to some extent replacing metal-cutting. Again, waste may be recovered in the production process itself; thus beneath the lines of presses in the Pressed Steel factory at Swindon, is an automatic scrap recovery line housed in concrete caverns, with bales of crushed metal as its product. Wastes may also be accumulated after the production process, as in the chemical industry. Or they may be recovered from the user, as with paper and metal scrap—a form of material recycling.

It would also be necessary to ascertain: whether the waste material is in bulk or trace quantities, whether safe or hazardous, transportable or untransportable, usable or intractable, whether in solid, liquid, or gaseous form, or even energy—waste heat recovery is indispensable to good industrial practice.

Tin from Cans

Domestic wastes perhaps present the greatest problem, since, becing produced on a consumer scale, they are not only bulky but exceedingly diverse in content. So far practical separation has only been possible in terms of paper, tins and organic refuse. There may be little value in recovering the tungsten filaments from electric light bulbs; but already a firm in the 600 Group is extracting tin from cans on a commercial scale. No doubt the compartmented dustbin, whereby the housewife can help in the process of recovery, is impractical, but perhaps she would be willing to save certain items for separate collection—as she did in wartime. Waste disposal at the sink may become a mandatory feature of every house, complete with built-in separator.

As our economy tightens up and we are called upon to produce more goods from less material, conservation will become more and more important. These questions will increasingly be asked: What do we wish to be rid of? What do we want to reclaim? Otherwise in the words of one Pucklechurch victim, interviewed on BBC "Tonight": "We shall be picknicking in all the muck we aren't swimming in."

Belfast for the New Cunarder?

Competition to build the replacement for the Queen Mary will be intense. The rival yards, most of them unfortunately able to quote higher than average unemployment figures in their areas and future risks of under-employment from the yards themselves, are able to point to intensive modernisation schemes, carried through at heavy cost and with great faith in the industry's future.

John Brown, the builders of the two still-sailing Queens, have not only the claim of a substantial redevelopment programme since the war but their long association with Cunard to support them once the tender, recommended by the Chandos committee and approved by the Government, is put out. But there are others. The Fairfield Shipbuilding and Engineering Company, at Govan, on the Clyde, can look back into their history and point out a former holder of the Blue Riband of the Atlantic and other luxurious ships for the North Atlantic. Swan, Hunter and Wigham Richardson on the Tyne, Harland and Wolff, at Belfast, and Cammell Laird, at Birkenhead, all three have put through technical advances and bigger-ship programmes that give them serious claims.

From the employment point of view there is a lot to be said for building the new Cunarder at Belfast. All the ship-building areas need the job—that is common ground—but Glasgow's unemployment problem is to be eased by the steel and car expansion schemes and Liverpool's by car developments; though it is not so easy to see similar answers to the problems of the North-East, particularly because of the modern working practices which Pressed Steel, or any other competitive firm, would have needed to bring into the region.

Belfast remains as a problem area of unemployment to which a full answer has still to be found. Investment there has often come from the United States. Many of the passengers of the new "Queen" will be Americans, and of the more leisured and presumably influential type. "Belfast built," as the proud slogan stemming from having constructed a great new liner, would be a powerful aid in interesting industrialists in the benefits of Northern Ireland.

of the High Cost of London Dock Strikes

From the British Electrical and Allied Manufacturers' Association to the Timber Trade Federation of the United Kingdom, 50 widely varying trade associations endorsed the appeal to the Prime Minister, by Lord Ebbisham, the president of the London Chamber of Commerce, for "urgent consideration" by the Government of the disturbed record of labour relations at the London docks.

The cost over the post-war years has been enormously more than anything the nation may have suffered from disputes on the railways. Lord Ebbisham made the comparision, a threatened rail strike—perhaps because it instantly effects people, i.e. voters—is given emergency treatment, and there is little hesitation in the Trades Union Congress and the Ministry of Labour appearing on the scene. Dock strikes just drag on.

The recent tally clerks strike, whether based on genuine fears for future employment or not, has held up not only food and raw materials but manufactured goods, the great majority of which were produced to firm delivery dates. Eventually the products will get to their destinations, if the order is not cancelled out of hand, but will they earn repeat orders?

If the products give technical satisfaction they have got off to so bad a start that this will probably be taken as no more than is due. The reaction of the customer to troubles along the road can be imagined. And when the final day of replacement comes, especially if London dock strikes continue with their past frequency, it is hardly unreasonable to suppose that the overseas manufacturer, having as long a memory as the rest of us, will turn to countries where serious upheavals in the docks are given the attention of the leaders involved.

It is a barren argument to discuss whether the Transport and General Workers' secretary, Mr. Frank Cousins, should have been in Scarborough talking about the defence policy of a party which is not unanimously supported by his members, or in the London docks caring for the direct industrial interests of his members.

The disruptive effect on the deliveries and therefore the good name of the manufacturer, due to London dock strikes is costly and beyond doubt a national problem of Royal Commission seriousness. That a highly different and closely knit body of men like the London dockers can be effectively led from Smith Square, Westminster, the Transport Union headquarters, is by no means proved. The evidence since the war, and the cost to the exporting industries of the frequent breakdowns, suggests that it cannot be done.

and Continuous Compost Production

Clean Air Act or not the suburban week-end air is still commonly filled with the smoke and smells of bonfires.

Quantities of garden and vegetable waste that should be slowly turning itself into valuable soil-improving compost is destroyed, in return for, occasionally, a little potash. But there is hope for better things, many gardeners have graduated from the bonfire to the compost heap, and the Department of Scientific and Industrial Research reports in its booklet *Waste or Wealth* that some local authorities operate composting plant, often using modern continuous processing techniques.

The volume and value of industrial wastes is such as to create dangers of uneconomic operations through poor waste utilisation. There are equally opportunities for new products and profits from the imaginative use of apparently useless waste material.

An example that goes all the way up to the highest social values comes from that difficult waste product—pfa, or pulverised fuel ash, the fine dust produced in large quantities from numbers of electricity generating stations. Time and money is spent on carting boat loads of pfa out to sea and dumping it there.

Study of this voluminous material has led to the successful development of certain uses, the most interesting from work sponsored by the Central Electricity Generating Board. Briefly this research has shown that land can be reclaimed for agricultural use by using pfa without any additional top soil. Suitable grasses will grow and can be ploughed in for humus, sheep can then be grazed over the land further increasing its useful soil content.

Waste Reduction

One of the spectacular wastes is, of course, in paint, where millions of gallons are fired into spray booths every year only to be washed off the walls and disappear eventually into dumps. The re-use of recovered paint is nothing new in the United States and Canada but the DSIR have not been able to arouse much interest in Britain.

Instead attention has gone into finding various ways in which the amount of paint that is wasted can be reduced. Among the best of these is electrostatic spraying in which the paint spray is charged to a high electric potential and becomes attracted to the surface to be sprayed.

The fields in which waste is created are as numerous as those in which human activity is engaged. "Where there's muck there's brass" may be an old fashioned Lancashire saying but it lacks nothing in present application.

Changing Attitudes Towards Metal Scrap

Process scrap can be avoided but consumer-product deterioration can only be delayed. So for the national good it pays to have cheap and methodical ways for recycling scrap. Handling and sorting methods need further thought.

By Miss E. P. Wood

Director, George Cohen, Sons and Company

IF EVER you have a look at a mixed heap of scrap anywhere, you will agree that a more heterogeneous accumulation of things in a comparatively restricted space could scarcely be imagined. In fact, even to the initiated it can never appear short of a miracle that any sort of order can be brought to what, at times, looks like complete chaos. Yet such order must be achieved if scrap is to do its proper job, that is to supply the iron and steel maker with a comparatively cheap form of raw material.

Such a stack of scrap would probably contain pieces of steel plate, channel or other sections, corrugated sheet, dust bins, old tanks, lathe turnings, cast iron pipe, machine beds, plates, etc., and befcre this varied collection can be made suitable for the furnaces, a considerable amount of sorting and preparation is necessary.

"A more heterogeneous collection of things . . . could hardly be imagined."

PREPARATION

Generally speaking, what must be aimed at is the preparation of good, dense scrap which gives the consumer the maximum charge in the shortest time in whatever melting plant is used.

In this context, the necessity must be borne in mind of meeting the exact requirements of modern iron and steel making and yet keeping costs of scrap preparation as low as possible, since the use of scrap is largely governed by its cost relation to the use of other raw materials. There are, however, advantages in using scrap such as the fact that the consumer starts with a refined raw material of more or less known chemical analysis and with good "packability."

Scrap must be prepared to numerous specifications to suit the purpose and uses of the different consumers, and these specifications vary as to size, thickness, bulk and analysis.

Reverting to our mixed heap, material like the steel plate and channel in around 5 ft lengths would normally go for open hearth steel-making in several thicknesses down to about $\frac{1}{4}$ in. On the other hand some melters would want this type of material in varying lengths down to 6 in and this is dependent upon the cupola or furnace that they are using.

Where material has to be cut to different sizes, shears of numerous types are used. The more massive types of scrap which cannot generally be handled by the majority of shears have to be burnt by oxygen and acetylene or other cutting gases although there are in use today giant hydraulic shears which can, in fact, deal with nearly everything and obviate burning to a very great extent. This is of the greatest importance in such territories where the cost of gases, due to exorbitant transport costs, may make burning uneconomic.

Again, all light, bulky material has to undergo special preparation and processing, and in order to produce the desired sizes, qualities and densities, a number of types and makes of hydraulically-operated presses are in use. These make good, solid, cuboid or rectangular briquettes which can weigh anything from $\frac{1}{2}$ cwt to several tons per briquette, depending upon the power of the press used and the size of the briquette produced. Before going to the presses, scrap must be sorted into uncoated scrap and coated scrap such as tinned, enamelled, galvanised and terneplate, etc. The reason for this is that coated material cannot be used in the open hearth furnace without detriment. Coated material can, however, be absorbed in the pig-iron producing blast furnace where much of the deleterious matter can, by one method or another, be disposed of or diluted to a minimum. Tin-coated scrap can also be treated by means of a number of tin removing processes leaving clean steel, the majority of which after being compressed into briquettes is absorbed by the steelmakers in their open hearth furnaces.

Also included in the bulky scrap category are the long, stringy, bunchy lathe turnings or swarf. To make them manageable and suitable for economic charging, particularly for blast furnaces, these are fed like sausage meat into swarf crushing or chip breaking machinery, out of which they come in small pieces of about 4 in to 5 in or even less.

Large tonnages of scrap arise from old machinery, structures, gasholders and other industrial sources. Some of this is absorbed by the open hearth steel-maker who will use it in pieces of size governed by his charging boxes, which in this country could be anything up to 5 ft 6 in by 2 ft 6 in by 2 ft 6in. A very large tonnage of this material is used by the cast iron foundries and here, due to the limitations set by the size of the cupolas used, scrap has mostly to be reduced to pieces weighing not more than 1 cwt and probably not bigger than 2 ft by 1 ft by 1 ft if, indeed, as big in many cases. Cast iron, as a rule, is not difficult to break when it is thin, but when it is a question of reducing such things as fly-wheels and lathe beds then this can only be done by balling—that is by dropping a heavy steel ball from a height on to the material which is to be broken and even, in the cast of more difficult material, dynamiting.

The foregoing presupposes the use of mild steel scrap and ordinary cast iron scrap for the production of mild steel and ordinary iron castings. But it is one of the functions of the scrap industry, and a very important one, to sort, grade and test scrap for alloys. The reasons for this are two-fold; first to ensure that scrap contaminated with alloys should not be sent to consuming works for the making of mild steel since such scrap would have a deleterious influence on the steel, and second that alloy-bearing scrap is directed to the alloy steel makers who would ordinarily have to buy the alloys in the form of virgin metal or ferro-alloys.

IDENTIFICATION

Distinguishing alloy scrap from mild steel is effected in a number of ways. In many cases it is possible to tell from the use to which the steel

(Left) Typical shears used for cropping of scrap.

(Right) Scrap, cut to size, awaiting shipment.

component or article has been put whether it is mild steel or alloyed. For example, constructional steel is known to be commercially alloy-free, whereas material which is more highly stressed might be alloyed with such metals as nickel, molybdenum, manganese, chromium and in smaller percentages with other elements less widely known. Once it is suspected that alloys are present, various tests can be applied, i.e. spot, spark or analytical. The presence of nickel, for example can always be confirmed by spot testing with nitric acid and dimethylglyoxime. If the result is a pink stain on the filter paper, the presence of nickel is established and the actual percentage can then be ascertained by analysis. There are other spot tests which can be applied for other alloys. There are also spark tests for such other alloying metals as tungsten.

The conservation of alloys is important not only because alloys in scrap come cheaper than virgin metals, but also from the national aspect of reduction of imports. Most alloys come from abroad and it is, of course, vital to the economy that such imports should be kept to a minimum.

For statistical purposes, it is usual to split scrap arisings into three major categories, *viz.* "circulating scrap," that is scrap which the steel industry itself returns to the furnaces in the shape of sheared-off ends of ingots, blooms, etc.; "capital scrap," that is scrap from any article which has come to the end of its functional life—the stack of scrap which we have just been looking at in imagination would come into this category—and, finally, "process scrap," that is scrap from steel-using industries where processes such as cutting, pressing and stamping are in common use.

NEED FOR BETTER SORTING

As far as process scrap is concerned, great strides have been made by the producing works in sorting, segregating and cleansing at source, but much more could be done. Far too much alloyed scrap is being mixed with the mild steel, to an extent which makes it extremely difficult for the scrap merchant to sort.

Proper segregation at source would result in greater conservation of alloys and reduce the possibility of contamination of steel in the melt. Some machine shops producing swarf take steps to render their turnings oil-free, but the use of centrifugal extractors and washing. Swarf should be kept clean of shop sweepings of dirt and non-ferrous material, but many people are negligent in this respect, producing swarf which is of little value and extremely difficult to dispose of for remelting.

As steel capacity has increased, so scrap production has become proportionately greater. This has necessitated a far more extensive use of scrap processing plant and a greater application of mechanisation on the scrap handling side. There is more general use of grabs and magnets, and a recognition of the need for mobile equipment. Thus, in modern scrap yards, mobile cranes, shears and presses are available for use when it is more economic to take the plant to the scrap than to bring the scrap to the plant.

AUTOMOBILE SCRAP

With one exception, the handling and sorting of scrap, generally speaking, present the same problems throughout the world. This one exception, for which, because of its magnitude, a solution has already been found in the USA, will, in the not so distant future, require an answer in this country. In the USA where the number of motor cars per capita is about three times the number in the UK, it is the practice to change cars frequently—in fact, a car is usually changed after a year or two, and second hand ones mostly scrapped after a very short period—so some method had to be found there of dealing economically with the vast numbers of scrap automobiles which arise every year. With the implementation of the law governing the ten year test for cars, a similar problem will surely very soon present itself here. The USA have managed to overcome this difficulty by installing plants which, after the body has been removed from the chassis and the engine taken out, pass the car through an incinerator where all inflammable material is burnt. What remains is charged into giant baling presses which take two bodies at a time, reducing them dimensionally to steelworks requirements.

Finally, steelworks, depending upon their process, can use up to 100 per cent of scrap in their melt or no scrap at all where they are integrated with blast furnaces. But overall, the average proportion of scrap used, as compared with pig iron, is over 50 per cent of steel ingot output. Since the price of scrap is an average of £10 to £11 per ton and the price of pig iron is in the neighbourhood of £20 per ton, there is an advantage of around £9 per ton for every ton of scrap used instead of pig iron. It is therefore not difficult to understand why the collection and preparation of scrap has developed into an industry of such vast dimensions, supplying the furnaces of Britain with many millions of tons annually. The scrap industry employ many tens of thousands of men, plant installations worth millions of pounds and transport vehicles in their thousands—a colossal and vital stake in the overall economy of the country.

Jones KL44 mobile crane—product of the 600 Group—fitted with 36 in electromagnet for scrap handling.

Fully automatic hydraulic baling press at the Canning Town depot of George Cohen.

Refractory Metal Scrap is an Embarrassment

While scrap recycling avoids the piling up of waste material it can often prove a false economy. This is especially true when the cost of reclaiming and refining is several times the cost of the basic material. Many factors contribute to make the picture so complex, though, that no clear-cut trends in processing technology can be illuminated. But an informed correspondent at Murex sums up the changing attitude towards recycling refractory metal scrap when he says: "We believe that costs of classifying molybdenum and tungsten scrap to the necessary degree of accuracy will tend to rise and that no techniques will be developed which will permit the return of scrap to the high quality production line. As costs of labour, packing and transport rise, whilst efficiency of mineral winning, classification and processing increases, the *prospects for general re-utilisation of scrap grow worse.*"

Is this comment that scrap is becoming more and more an embarrassment true for all metals? Undoubtedly not. The market for steel scrap is large and it would be foolhardy not to recycle the metal when it is worth nearly half the value of refined steel, and this itself has a value half that of the finished product. But a glance at the price structure for refractory metals such as molybdenum and tungsten reveals that there is no method of recycling these metals economically to make high quality metal, and that the price of scrap is determined by what the makers of ferro-alloys and alloy steels will pay. Thus molybdenum scrap from bars and sheet costing up to £7 per lb which has been made from high quality metal powder at £1 10*s* per lb may be acceptable to the ferro-alloy plant at no more than 10*s* per lb (although in certain circumstances heavy clean material may command up to 14*s* per lb for "commercial" metal manufacture). Again clean tungsten scrap from sheet or rod which may have been priced at £15 per lb or £3 per lb respectively and which has been made from pure metal powder costing, say, £1 per lb, would be valued today at less than 8*s* per lb as feed to the ferro-tungsten plant. Grindings which may be more difficult to identify would be priced at an even lower level.

It is therefore wise counsel to employ metal-working methods which avoid production of large quantities of scrap, and the lack of a foreseeable break-through in recycling technology for those metals such as beryllium, niobium, titanium, tungsten or molybdenum, where the cost of working is so many times that of the raw material, adds weight to this advice.

During the last six years of marketing wrought titanium products in the UK, ICI have been able to reduce their prices to well under half the 1954 levels, but this is attributable only partly to the fact that they have learned to recycle their own process scrap. Industrial scrap in this metal is still generally unusable and commands the low price which makers of alloy steels will pay, as for tungsten. If trade scrap is ever accepted for recycling in the metals mentioned here it will certainly only be bought under an individual agreement with the firm concerned. Meanwhile metal workers must accept the attitude of Murex on tungsten and molybdenum when they say: "We do not seek scrap and should generally be happier without it but we do accept small quantities to oblige certain customers."

Plain Words

By Capricorn

THE effluent of an affluent society! What scandalous waste we so-called civilised people permit. One of the Steinway brothers, of pianoforte fame, to whom I talked in New York, bemoaned the terrible waste of food which he saw every day in the garbage bins of the block of flats on Long Island where he lived. His family were refugees from Europe, so they were perhaps more conscious of the preciousness of bread than most of us in these never-had-it-so-good times.

But it is not the waste of food or material things—a subject that is well treated in this issue of ENGINEERING—but ways of wasting time that concern me. The various laws of conservation tell us that though we may waste things, nothing is completely destroyed; it is only transformed into another form. But time *is* destroyed. It is the one vital element in, for example, running a business which does not appear in the balance sheet except indirectly. Yet it is the one element which, if its stern implications are mastered, can give a return without an investment.

The People's Inspectors of Hungary know all about the cost to the State of workers wasting time. They are using cameras to check the efficiency of labour. They have found that the photographic records reveal that 14 to 16 per cent of the total work time is wasted in the Ganz-Mavag locomotive factory in Budapest. The blame is reported to have been laid partly on the "loose working morale" of the workers and partly on poor organisation.

I would like to know just how they worked out the 14 to 16 per cent. In my experience, all manual work, if it is to be done efficiently and without waste, needs concentrated thought and direction from the mind at intervals as the work progresses. The moulder preparing a complicated sand mould may be seen to wander away from his job and "waste time," but the probability is that his mind is consciously or unconsciously sizing up the next stage in his work. His mind is searching, like a computer, in the memory of his experience, for other jobs which in one technique or another have a bearing on the job now in hand. When he returns from his ten-minute wandering, he is like a painter standing back from his canvas—he can take a fresh, objective view of it.

The man who appears to be filling every unforgiving minute is often the least efficient worker. The man who appears to be taking things easily is often the most efficient worker. He is letting his brain save his brawn.

No, the People's Inspectors of Hungary must search a little deeper into the question if they are going to effect any improvements. We in the West might look into the question, but from a different angle. Could we not ask simply how it is that with all our wealth, most of us have so little time to spare?

Letters to the Editor

Selecting Future Foremen

SIR, I was very interested to see the article headed "A National College for Future Foremen?" (ENGNG., 7 Oct. '60, p. 478), and also the second article, entitled "Foremen: Leaders or Not?" (14 Oct. '60, p. 505).

It has always been the view of the British Institute of Management that the foreman is an essential member of the management team. His training, therefore, is of vital importance at this stage of the world's development, when survival is likely to be dependent on better management and the better use of all the resources at our disposal, whether human or material. The training of foremen is thus of the greatest interest to our members.

There are many and varied views as to how this can best be achieved as is obvious from your article. The solution which is most effective in one set of circumstances may well be ineffective in another. Mr. W. G. Richardson of Intermit is in favour of creating a National Foremen's College. There may well be others who will feel that foreman training is best dealt with by means of courses organised within the firm.

Considerable benefit might be obtained if a one-day conference were held to discuss the valuable information which has come to light as a result of your survey. I should be glad to hear from any of your readers who would be interested to take part in such a conference and of any particular points which they would like to have discussed. If replies indicate that there is a general desire for such a conference, then the British Institute of Management will make the necessary arrangements.

Yours faithfully,
F. G. C. CUTCLIFFE,
Head of Education and Training Division.
British Institute of Management,
Management House,
80 Fetter Lane, London, EC4.
12 October, 1960.

SIR, The interesting survey which you have undertaken on the position of the foreman recalls in almost every detail the discussion that took place on the same subject during the war. Today, as then, this discussion turned on his remuneration, his status, his loss of authority to specialists and on the means of training him to exercise authority. Then, as now, such expedients as TWI (Training Within Industry), short residential courses, foremen's associations and libraries were extensively canvassed. Are we back where we started?

Surely what is first needed is an examination of the foreman's job and, from this, a study of the human requirements and training needed for it. It surely cannot be the case that the same qualifications are needed in the supervisor in a chemical plant (who may well need to be a graduate), the foreman in a firm making specialised electronic equipment (who should be a highly trained technician), the foreman in a heavy engineering works (who probably needs to be a combination of highly skilled craftsman and technician) and the foreman in a mass-production factory (whose task is almost entirely organisation and labour control).

Is it not time that we recognised the educational revolution that has taken place since the war and gave up expecting to find managerial talent in any quantity on the shop floor? If a boy has not gone to grammar school and university he will, if he has the ability, go from the Ordinary National Certificate to Dip. Tech. In fact, it will become increasingly difficult to find holders of the Higher National Certificate who are capable of going on to professional qualifications. (See the evidence to the Select Committee on the Nationalised Industries which examined British Railways.)

Is it not time that we took the education of technicians seriously and recognised that the Higher National Certificate or, better still, a new Higher National Diploma, taken in a three-year sandwich course, should be an award worth acquiring, and worth reaching for, its own right; and not as a step to something else?

If this were done, we should not only provide for the increasing number of technicians of all types which we are going to need but, if the courses were of a sufficiently varied nature and included the appropriate non-technical subjects, we should at the same time be providing a pool of educated and trained foremen which we have, apparently, lacked for so many years.

Yours faithfully,
AUSTEN ALBU.

House of Commons,
London, SW1.
17 October, 1960.

SIR, My fellow directors and I were most interested in your recent national survey of the "foremen problems" confronting firms large and small.

Hundreds of companies clearly support your conclusions that matters will only improve when the foreman is reinstated as the first line of management. Through our own surveys done two years ago we realised these problems and believed that if industry only knew the facts, companies would act sensibly and responsibly.

So, nearly two years ago, we set out to help companies to meet these needs by assisting them to plan and then carry out adequate executive development programmes for all levels of authority from director to foreman.

But we have been particularly concerned with the foreman. Why the foreman? Because, as we all know, the job of the foreman has undergone considerable changes in the past 30 years. No longer is he in complete control of his department. Nowadays, it is often normal for the shop steward to be the important medium of communication between the shop floor and senior management, the foreman being allowed to drift into the background ignored by both management and labour. It is because of this drift that management find it most difficult to get people from the shop floor to become supervisors and foremen; and because the pay is often less and they refuse to accept the responsibility, particularly when they feel that they are without the backing of top management.

Why has all this come about? Thirty years ago, the relationships and communications in a company were simple. The manager issued instructions and the foreman saw the work carried out. The executive line of command was clear and uncluttered, and authority unquestioned. Today, the foreman is surrounded by specialists and influences which previously did not exist and the purposes of which he does not feel he understands. Work study, personnel, planning, quality control, budgetary control and production control are instances. This has brought about a complete change of relationships and it is not surprising, therefore, that the old type of foreman does not fit into the modern pattern of industry.

The increasing influence of the specialist on the foreman makes the training of the foreman of vital importance. For, the foreman is, or should be, the spokesman of management, but to carry out his responsibilities he has to understand proper management thinking and to do so he has to be able to think analytically about his own job, especially in relation to other departments.

Management would never consider employing a fitter, an accountant or a work study engineer who did not have adequate training, yet a foreman and supervisor at middle and junior level hold positions in management for which more often than not they have had no special training. The loss incurred by a company through insufficient technical training is serious, but the loss brought about by bad management is incalculable.

Comparatively few firms can afford to maintain a department which is specifically directed at producing a programme for management training. Often, time alone would not allow this, so to bring this training to industry our company was formed and is, at the moment, serving over 60 firms by helping them encourage the thinking that is needed to cope successfully with the complexities of modern business.

We have our own college in which training programmes are developed, but, where circumstances do not permit companies to free their foremen for sufficient time to join these courses, we produce the requisite course to suit the individual company's needs and carry out the programme on the company's premises.

Yours faithfully,

ALEX BRUCE.

Supervisory Training Services Limited,
Beechwood Hall,
Loudwater, High Wycombe, Bucks.
17 October, 1960

A Bridgehead for Trade

SIR, Having spent several years developing trade between my company and controlled economy countries, I was very interested to read Mr. E. P. Ward's article " Czechoslovakia: A Bridgehead for Trade?" (ENGNG., 30 Sept. '60, p. 438).

I can confirm practically all that he says as being very much in line with my own experiences. That Czechoslovakia is a healthy and potentially great market for British-manufactured goods is being proved by our experiences. More than this, the Czechoslovak industrialists, with their renowned experience in engineering technology, are every ready to recognise the qualities of a product. We were particularly proud a few months ago to receive a pennant from the mighty Skoda Engineering Corporation, which they sent to us as a mark of their appreciation of the quality of the industrial trucks they have purchased from us. It is, of course, well known that there is a sizeable industrial truck activity in Czechoslovakia itself.

However, as Mr. Ward is at pains to point out, the shortage of sterling in Czechoslovakia frequently leads the importing enterprise to seek barter deals. Personally, I do not agree with Mr. Ward that this facet is less true with Czechoslovakia than it is with any other east European countries. However, with the relatively small exporting company, the ability of the small British exporter to do anything in the way of a barter deal is frequently very limited indeed. The Rootes Group case which you cite, whereby machine tools and timing chains were purchased against a contract for £250,000 worth of cars can only apply to big corporations like these.

Therefore, having seen something myself of the excellence of Czechoslovak products and calculating that these are broadly competitive in price with comparable products in this country and the West, I feel that there is some considerable scope for Czechoslovakia, and any other socialist country for that matter, to do something themselves about sales promotion in the West.

I am convinced that the market for Czechoslovak products in this country could be enlarged appreciably and the sterling earned would then certainly give greater impetus to our own exports to them. Organisations like Exico Limited, mentioned by Mr. Ward, certainly do a good job with very limited resources. I feel that there is ample evidence to suggest that the Czech authorities themselves could do a lot more in the way of sales promotion in Britain.

Just as it is frightfully complicated for the British exporter to learn the ropes of how to trade with the socialist countries, so must it be something of a problem for the Czech exporting enterprises to understand the tricks of the trade in selling their products in a free enterprise economy. Therefore, my personal feeling is that one of the most promising means for Czechoslovakia to build up its trade with Britain is to take a little more aggressive attitude in her methods of sales promotion in this country and, indeed, in the Commonwealth.

That Czechoslovakia would prefer to build up her trade with Britain and depend less on Western Germany is widely appreciated, but like me, I feel sure that there are many British exporting companies who frequently meet difficulties which, as an individual company, they can do little to resolve.

Personally, I do not think the import and export enterprises of the socialist countries particularly like the means that are sometimes resorted to in negotiating barter deals through third parties, and I have found that they appreciate very much the ability to talk directly with the manufacturers themselves.

Finally, I would like to mention the International Trade Fair at Brno. This is a really well organised exhibition, of which the authorities are justifiably proud. I believe the Fair for 1961 is planned to be bigger than ever, and British exporters eager to develop their trade with Czechoslovakia would do well to consider the Brno Fair.

Yours faithfully,

A. A. POTTER,
Overseas Manager.

Lansing Bagnall Limited,
Kingsclere Road,
Basingstoke, Hampshire.
13 October, 1960.

Congestion and the Traffic Engineer

SIR, In his review of the recent publication *Roads and Their Traffic*, Mr. J. L. Waldron puts forward his own views on the solution of the London traffic problem (ENGNG., 30 Sept. '60, p. 455).

He calls for still more control and regulation of traffic, which, from his discrediting criticisms of the work of the true traffic *engineer* and his own professional interest, appears to imply extensions of the police measures which so vex big-city motorists, rather than control by engineering works by which town planners are striving to achieve the segregation of pedestrian and vehicle. Extension of police regulation will do more to hasten decay of city centre business than mere traffic congestion itself and is no substitute for new construction.

Mr. Waldron wants to reduce collisions by eliminating street crossings and right-turns yet cannot bear to see elevated or depressed highways in London! He is another promoter of the hoary old " ring principle " *two to three miles from the centre*, and, within the ring, he would put the public at the mercy of the taxi-cab and the London Transport Executive and their rising-cost spiral.

Ring-road thinking is outdated. There is a greater danger of wasted expenditure on ill-conceived projects of this nature than on origin and destination studies of demand. The demand for radial movement and central-area space is much less fluid than Mr. Waldron suggests and can be predicted sufficiently accurately to establish the fact that there is justification for the construction of a number of new radial routes right to the centre. The most urgent need today is to reduce the pedestrian-vehicle conflicts and the only effective way to do this is to remove inessential vehicles to motorways from streets heavily populated by pedestrians. There is an instance of a 50 to 60 per cent reduction of daily traffic volume on streets paralleled by an incomplete new motorway and an even greater reduction of peak-hour flow. Streets which had been made clearways before the motorway came are returning to their original function; parking is allowed again and business is improving.

I am at present being given an opportunity to study at first hand American methods of city planning and also to teach the subject to American students. The big cities here, faced with a situation quite similar to London's, are approaching their problems in a remarkably zealous manner. Recognising the declining business of the central areas and the suburban vitality, careful appraisals are being made of the new true function of the centre of a metropolitan area in the present age.

One of the answers coming from these studies is the need for improved communications between centre and suburbs. Where the city authorities move too slowly in promoting new construction and comprehensive renewal of worn-out areas, city businessmen will themselves hire a first-class planning team, have designs prepared and then persuade the city to adopt them. There is also a remarkable difference in construction speed and method. None of this " wait until the whole job is complete and have a ceremonial opening "; here the job is started at one end and, as each section becomes usable, it is opened to traffic.

That way the demand for more and faster construction is promoted and the vitality of the city maintained.

Yours faithfully,

J. A. PROUDLOVE,
Visiting Professor.

College of Engineering,
University of Kentucky,
Lexington, KY, USA.
12 October, 1960.

Institution Amalgamations

SIR, The terms and conditions of the proposed amalgamation of the Civils and the Municipals have now been issued to the members of these Institutions. In view of the interest of the Privy Council, these terms are not the exclusive domestic concern of the two contracting parties and their constituent members.

The proposals include the formation of a " Branch " of the Civils, the affairs of which Branch are to be directed by a " Board," the membership of which Board is to be restricted to " practising " Municipal and County Engineers, a class of persons explicitly defined as follows:—

" ' Practising Municipal and County Engineer ' means a person who holds an appointment under a Local Authority as defined in the Local Government Superannuation Act, 1937, or any Act amending or extending the same or under a public authority of a like nature."

In short, a necessary qualification for membership of what may well become a shadow Council of the Civils is to be the holding of a particular type of salaried pensionable appointment.

Such a restriction, which would so obviously be necessary in defining the membership of a staff association, seems repugnant to the spirit of a professional and scientific society " incorporated by Royal Charter of the 3rd June, 1828, for the general advancement of Mechanical Science and more particularly for promoting the acquisition of that species of knowledge which constitutes the profession of a Civil Engineer."

Yours faithfully,

E. H. BATEMAN,
M.I.C.E.

Farnham, Surrey.
13 October, 1960.

Events in Advance

Exhibitions and Conferences

Large Dams, Seventh International Conference.—Mon., 26 June, to Sun., 9 July, 1961, in Rome. Organised by the International Commission on Large Dams of the World Power Conference. Apply to the secretary, British National Committee on Large Dams, 201–202 Grand Buildings, Trafalgar Square, London, WC2. Tel. WHitehall 3966.

Pipes, Pipelines, Pumps and Valves, Second International Exhibition and Convention.—Mon., 9 April, to Fri., 13 April, 1962, at Earl's Court, London, SW5. Organised by the Exhibition

Division, Scientific Surveys, Ltd., 97 Old Brompton Road, South Kensington, London, SW7. Tel. KNIghtsbridge 9360.

Century 21 Exposition.—Sat., 21 April, to Sun., 21 Oct., 1962, at Seattle 9, Washington, USA. Stated to be the first international exposition in the United States since 1939. Under the patronage of the United States Government. Theme: "Man in the Space Age." Apply to the director of information, Century 21 Exposition, Exposition Building, Seattle 9, Washington, USA.

Compressed Air and Hydraulics Exhibition and Conference, Second International.—Mon., 30 April, to Fri., 4 May, 1962, at Olympia, London, W14. Organised by *Fluid Power, Incorporating Compressed Air and Hydraulics*, St. Richard's House, Eversholt Street, London, NW1. Tel. EUSton 7293.

Large Electric Systems, International Conference on.—Wed., 16 May to Sat., 26 May, 1962, at the Foundation Berthelot, 28 Rue Saint Dominique, Paris. Organised by the Conférence Internationale des Grands Réseaux Electriques (CIGRE), 112 Boulevard Hausmann, Paris. Apply to the British National Committee, Thorncroft Manor, Dorking Road, Leatherhead, Surrey. Tel. Leatherhead 4151.

Rubber Technology Conference, Fourth.—Mon., 21 May, to Sat., 26 May, 1962, in London. Organised by the Institution of the Rubber Industry, 4 Kensington Palace Gardens, London, W8. Tel. BAYswater 9101.

Instruments, Electronics and Automation Exhibition.—Mon., 28 May, to Sat., 2 June, 1962, at Olympia, London, W14. Organised by Industrial Exhibitions, Ltd., 9 Argyll Street, London, W1. Tel. GERrard 1622.

Coal Preparation, Fourth International Congress on.—Mon., 28 May, to Fri., 1 June, 1962, at Harrogate. Organised jointly by the Coal Preparation Plant Association; and the National Coal Board, Hobart House, Grosvenor Place, London, SW1. Tel SLOane 3401.

History of Science, 10th International Congress on.—Sun., 26 Aug., to Sun., 2 Sept., 1962, at Cornell University, New York, and the headquarters of the American Philosophical Society, Philadelphia, Penn., USA. Apply to the secretary, 10th International Congress of the History of Science, Cornell University, Ithaca, New York, USA.

Foundry Trades Fair, Second International (GIFA).—Sat., 1 Sept., to Sun., 9 Sept., 1962, in Düsseldorf. As in 1956, when the first fair was held, the German Foundrymen's Association will hold their annual meeting during the fair. Organisers: Nordwestdeutsche Ausstellungs-Gesellschaft m.b.H., 4 Ehrenhof, Düsseldorf, Germany.

Food Science and Technology, First International Congress.—Tues., 18 Sept., to Fri., 21 Sept., 1962, in London. Apply to Lieut.-Colonel Francis J. Griffin, 14 Belgrave Square, London, SW1.

Fuel Efficiency, Annual Refresher Course on Current Practice in.—Mon., 24 Sept., to Fri., 28 Sept., 1962, at the Clârendon Laboratory, Oxford. Fee, including accommodation, £15 15s. Organised by the National Industrial Fuel Efficiency Service, Ailsa House, 181 King's Road, Reading, Berkshire.

Gauge and Tool and Power Press Exhibition, Sixth.—Mon., 1 Oct., to Wed., 10 Oct., 1962, at Olympia, London, W.14. Organised by the Gauge and Tool Makers' Association, Standbrook House, 2–5 Old Bond Street, London, W1. Tel. HYDe Park 3451.

Laboratory, Measurement and Automation Techniques in Chemistry, Second International Congress and Exhibition (ILMAC).—Mon., 15 Oct., to Sat., 20 Oct., 1962, in the buildings of the Swiss Industries Fair at Basle. Apply to ILMAC, 61 Clarastrasse, Basle, Switzerland.

World Power Conference, Sixth Plenary Meeting.—Sat., 20 Oct., to Fri., 26 Oct., 1962, in Melbourne. Organised by the Australian National Committee, 45 Little Lonsdale Street, Melbourne, C1, Victoria, Australia. Theme: "The Changing Pattern of Power." In Britain, application may be made to the secretary, British National Committee, World Power Conference, 201–202 Grand Buildings, Trafalgar Square, London, WC2. Tel WHItehall 3966. *Note:* There will be a Sectional Meeting in Switzerland in 1964.

Meetings and Papers

British Institution of Radio Engineers

BIRMINGHAM
"Industrial Applications of Automatic Control Using Electronic Techniques," by R. J. F. Howard. West Midlands Section. Department of Electrical Engineering, The University, Edgbaston, Birmingham. Wed., 26 Oct., 7.15 p.m.

BRISTOL
"Radio Aids for Automatic Landing Developed by the Blind Landing Experimental Unit," by J. S. Shayler. South Western Section. School of Management Studies, Unity Street, Bristol. Wed., 26 Oct., 7 p.m.

Building Centre

LONDON
"Straw Slabs for Farm Buildings"; and "Fire Test on 2 in Compressed Straw Slab"; films, exhibited by Stramit Boards Ltd. Wed., 26 Oct., 12.45 p.m.

Combustion Engineering Association

BIRMINGHAM
"Scheduled Maintenance of Boiler Plant and Auxiliaries"; discussion opened by F. W. C. Hinton. Midland Region, Engineering Centre, Stephenson Place, Birmingham 2. Wed., 26 Oct., 10.30 a.m.

Illuminating Engineering Society

LEICESTER
"Light Sources and Their Applications," by H. R. Ruff. Leicester Centre. Offices of AEI Lamp and Lighting Co., Ltd., Melton Road, Leicester. Wed., 26 Oct., 6.15 p.m.

Institute of Marine Engineers

LONDON
Observations on the Design and Construction of the N.S. Savannah," by J. A. Dodd and S. MacDonald. Joint Nuclear Marine Propulsion Panel. Tues., 25 Oct., 5.30 p.m.*

BIRMINGHAM
"Recent Developments in Pump Auxiliaries for Ships," by T. McAlpine and I. S. Paterson. West Midlands Section. Engineering Centre, Stephenson Place, Birmingham 2. Thurs., 27 Oct., 7 p.m.

SHEFFIELD
"Care and Maintenance of High-Pressure Watertube Boilers," by W. R. Harvey. North Midlands Section. BISRA Laboratories, Hoyle Street, Sheffield 3. Wed., 26 Oct., 7.15 p.m.

Institute of Road Transport Engineers

ACCRINGTON
"Taking Stock on Maintenancem" by P. H. Wyke Smith. Northern Centre. Commercial Hotel, Accrington. Wed., 26 Oct., 7.30 p.m.

Institution of Civil Engineers

LONDON
"The Application of Work Study to Local Authority Problems," by M. E. Habershon. Tues., 25 Oct., 5.30 p.m.*

Institution of Civil Engineers, Institution of Electrical Engineers and Institution of Mechanical Engineers

BIRMINGHAM
"Some Aspects of Engineering in Polar Regions," by D. L. Pratt. Birmingham and Midland Institute, Paradise Street Birmingham. Thurs., 27 Oct., 6.30 p.m.

Institution of Electrical Engineers

LONDON
"Southern Region's Kent Coast Electrification Scheme—Power Supply Apparatus": Chairman's Address, by A. Porter. London Graduate and Student Section. Mon., 24 Oct., 6.30 p.m.*

NEWCASTLE UPON TYNE
"Safety in the Utilisation of Electricity," by S. J. Emerson. North Eastern Centre. Neville Hall, Westgate Road, Newcastle upon Tyne. Mon., 24 Oct., 6.15 p.m.*

Institution of Heating and Ventilating Engineers

BIRMINGHAM
"Noise and Vibration Control in the Heating and Ventilating Industry," by P. H. Allaway. Graduates' Evening. Birmingham Branch. Engineering Centre, Stephenson Place, Birmingham. Tues., 25 Oct., 6.30 p.m.

EDINBURGH
"Engineering Services at the Western General Hospital, Edinburgh," by M. E. Vincent. Scottish Branch. 25 Charlotte Square, Edinburgh. Tues., 25 Oct., 7 p.m.

Institution of Mechanical Engineers

LONDON
"The Scientist's Contribution to Mechanical Engineering": Presidential Address, by Professor Owen A. Saunders. Wed., 26 Oct., 6 p.m.*

READING
"Mechanical Engineering Education in Technical Colleges," by A. J. Till, branch chairman. Southern Branch. Small Town Hall, Reading. Tues., 25 Oct., 7.30 p.m.

SLOUGH
"Performance Testing of the Complete Car," by A. Fogg. Crompton-Lanchester Lecture. Eastern Branch. Good Companions Hotel, Slough. Thurs., 27 Oct., 7.30 p.m.

SWINDON
"Modern Aids in the Design of Railway Bogies," by A. W. Manser. Western Branch. Technical College, Swindon. Fri., 28 Oct., 7.30 p.m.

YORK
"Future Developments in Corrosion Prevention," by T. Henry Turner. Yorkshire Branch. Royal Station Hotel, York. Thurs., 27 Oct., 7.30 p.m.

Institution of Plant Engineers

BIRMINGHAM
"Industrial Law," by T. W. Wright. Birmingham Branch. Imperial Hotel, Temple Street, Birmingham. Fri., 28 Oct., 7.30 p.m.

CARDIFF
"Thermal Insulation of Factory Buildings," by N. Foster. South Wales Branch. South Wales Institute of Engineers, Park Place, Cardiff. Tues., 25 Oct., 7.30 p.m.

LEEDS
"Building of a Modern Factory," by Philip Wyatt. West and East Yorkshire Branch. Houldsworth School of Applied Science, The University, Leeds. Mon., 31 Oct., 7.30 p.m.

LIVERPOOL
"On-Load Water Washing of Economisers and Their Heaters," by R. Sheen. Merseyside and North Wales Branch. Exchange Hotel, Liverpool. Thurs., 27 Oct., 7.15 p.m.

SHEFFIELD
"The Consultant and Personnel Management," by T. H. Hawkins. Sheffield Branch. Grand Hotel, Sheffield. Thurs., 27 Oct., 7.30 p.m.

Institution of Production Engineers

SHREWSBURY
"Development of Rubber in Engineering," by E. S. Kendall. Shrewsbury Section. New Technical College, London Road, Shrewsbury. Wed., 26 Oct., 7.30 p.m.

Institution of Structural Engineers

LONDON
"Structural Considerations of a New Animal Feed Mill in Belfast, Northern Ireland," by E. V. Finn and K. F. Shadbolt. Thurs., 27 Oct., 6 p.m.*

Junior Institution of Engineers

LONDON
"Formed Ends for Chemical Plant and the Like," by J. M. Tebby. Fri., 28 Oct., 7 p.m.*

Manchester Metallurgical Society

MANCHESTER
"Metallurgical Aspects in the Development of Fast Fission Reactors," by Professor C. R. Tottle. Manchester Literary and Philosophical Society, George Street, Manchester. Wed., 26 Oct., 6.30 p.m.

Reinforced Concrete Association

BRISTOL
"Practical Formwork Design and Construction," by J. G. Richardson. West of England Branch. New School of Engineering, The University, Bristol. Thurs., 27 Oct., 6 p.m.*

Royal Institution

LONDON
"Exploring the Ocean Floor," by Dr. Maurice Neville Hill. Fri., 28 Oct., 9 p.m.

Royal Statistical Society

SHEFFIELD
"New Uses of Computers in Statistics," by Professor G. A. Barnard. Sheffield Local Group. Grand Hotel, Sheffield 1. Thurs., 27 Oct., 7 p.m.

Sheffield Metallurgical Society

SHEFFIELD
"Dolomite," by Dr. D. F. McVittie. Refractories Group. BISRA Laboratories, Hoyle Street, Sheffield. Tues, 25 Oct., 7.30 p.m.

Society of Chemical Industry

LONDON
"Cathodic Protection." Brains Trust Meeting. Corrosion Group. Mon., 24 Oct., 6 p.m.*

BIRMINGHAM
"Will it Corrode?" by Dr. U. R. Evans. Midlands Branch Corrosion Group. Engineering Centre, Stephenson Place, Birmingham. Wed., 26 Oct., 7 p.m.

Society of Instrument Technology

LONDON
"A New Method of Strip Speed Measurement Using Random Waveform Correlation," by M. A. Butterfield, G. F. Bryant and J. Dowsing. Manson House, 26 Portland Place, W1. Tues., 25 Oct., 7 p.m.*

CHELTENHAM
"The Atomic Clock," by Dr. L. Essen. Cheltenham Section. Belle Vue Hotel, Cheltenham. Fri., 28 Oct., 7.30 p.m.

ELLESMERE PORT
"Analogue Computers," by W. E. Willison. Chester Section. Administrative Building, Associated Ethyl Co., Ltd., Oil Sites Road, Ellesmere Port, Wirral. Thurs., 27 Oct., 7 p.m.

GLASGOW
"Instrumentation of a Steel Strip Mill," by H. Gill. Scottish Section. Building Centre, 425 Sauchiehall Street, Glasgow, C2. Fri., 28 Oct., 7.15 p.m.

PORT TALBOT
"The Automatic Control of Rolling Mills," by W. N. Jenkins. South Wales Section. Offices of the Steel Co. of Wales Ltd., Port Talbot. Wed., 26 Oct., 5.30 p.m.

Television Society

LONDON
"New Standards and the Problem of Colour Television": Discussion. Cinematograph Exhibitioners' Association, 164 Shaftesbury Avenue, WC2. Thrus., 27 Oct., 7 p.m.

The address and telephone number of the headquarters of each institution are given below. Meetings in the headquarters town are held there unless otherwise stated. An asterisk (*) is placed where it is understood that refreshments are available prior to the time stated.

British Institution of Radio Engineers, 9 Bedford Square, London, WC1. (MUSeum 1901)
Building Centre, 26 Store Street, London, WC1. (MUSeum 5400)
Combustion Engineering Association, 70 Jermyn Street, St. James's, London, SW1. (WHItehall 5536)
Illuminating Engineering Society, 32 Victoria Street, London, SW1. (ABBey 5215)
Institute of Marine Engineers, Memorial Building, 76 Mark Lane, London, EC3. (ROYal 8493)
Institute of Road Transport Engineers, 69 Victoria Street, London, SW1. (ABBey 6248)
Institution of Civil Engineers, Great George Street, London, SW1. (WHItehall 4577)
Institution of Electrical Engineers, Savoy Place, Victoria Embankment, London, WC2. (COVent Garden 1871)
Institution of Heating and Ventilating Engineers, 49 Cadogan Square, London, SW1. (SLOane 3158)
Institution of Mechanical Engineers, 1 Birdcage Walk, St. James's Park, London, SW1. (WHItehall 7476)
Institution of Plant Engineers, 2 Grosvenor Gardens, London, SW1. (SLOane 0469)
Institution of Production Engineers, 10 Chesterfield Street, London, W1. (GROsvenor 5254)
Institution of Structural Engineers, 11 Upper Belgrave Street, London, SW1. (SLOane 7128)
Junior Institution of Engineers, Pepys House, 14 Rochester Row, London, SW1. (VICtoria 0786)
Manchester Metallurgical Society, The Kennedy Press, Ltd., 31 King Street West, Manchester 3.
Reinforced Concrete Association, 94-98 Petty France, London, SW1. (ABBey 4504)
Royal Institution, 21 Albemarle Street, London, W1. (HYDe Park 0669)
Royal Statistical Society, 21 Bentinck Street, London, W1. (WELbeck 7638)
Sheffield Metallurgical Association, 64 Crescent Road, Sheffield 7. (Sheffield 52865)
Society of Chemical Industry, 14 Belgrave Square, London, SW1. (BELgravia 3681)
Society of Instrument Technology, 20 Queen Anne Street, London, W1. (LANgham 4251)
Television Society, 166 Shaftesbury Avenue, London, WC2. (TEMple Bar 3330)

Waste Recovery Pays—Even in Prosperity

The economics of waste recovery are complex. Wastes of marginal value present a particularly serious problem, but may be usefully reclaimed—even where thrift is not the paramount consideration.

By Clement Brown

Department of Scientific and Industrial Research

IT IS difficult to think of a manufacturing industry that does not produce waste materials in the course of its daily operations. It is perhaps just as difficult, without specialised knowledge, to recall many instances of industries where large quantities of waste products from other processes are used as raw materials. On the other hand, it is well known that waste material from certain important and widely used commodities—metals, plastics and so on—can be recovered and reused. In steel production, for example, a considerable proportion of the feed material comprises scrap.

The discarded material may qualify as scrap, or it may never reach a scrap-heap; it is common practice to recover the more expensive materials within the factory, often as a normal part of the production process. But few people seem to know what happens to wastes of marginal value—apart from the unfortunates faced with the growing problem of disposal. Bulky dirt-cheap wastes, consigned to the rubbish dump because

Wastes may be recycled as scrap, converted into other raw materials, or simply thrown away.

of their lowly properties, are always likely to present the biggest difficulties—not least because they affect the greatest number of people.

What are the current reactions to the problem? In general the attitude of industry towards its wastes is influenced by its current economic and technical fortunes: in times of shortage many unlikely materials are pressed into service, but in prosperous times the cheap and humble wastes stand a poor chance against new materials which, although more costly, are technically superior and (usually very important) are normally more quickly and conveniently employed. Again it is sometimes argued that a product is inferior if it contains waste. This argument should be easily countered, but it is as well to remember that reactions largely depend on whether you are trying to dispose of waste or whether you are being exhorted to use it.

PROFIT FROM PROCESS WASTES

Geographical factors enter into waste utilisation problems: the expense of transporting the most common materials and byproducts—or even simple products made from them—militates against their use. This applies to wood and slate wastes, for instance, and to wastes, such as those from agriculture and food manufacture, which are bulky on account of a high moisture content. Yet there may be hope if users can establish themselves near the waste-producers; with good technical cooperation a successful commercial venture can result. Of course, some wastes are seasonal and a surfeit of a common material may well become worthless, so there is always good reason to seek new markets before they are needed.

Flourishing industries and services are bound to produce wastes, and these grow more embarrassing as the difficulty of dumping them becomes more acute. Research can provide the answer in many instances, providing the technical ways and means that will lead to dependable outlets. There are many calls on research workers' energies, however, and it is not generally to be recommended that investigations should proceed in the hope that something will turn up. A better starting point is a good idea, a technically sound inspiration born of knowledge of previous successes in comparable fields, with research to follow.

ASH AND ORGANICS

Research has provided at least a partial solution to the problem posed by the use of pulverised fuel in electricity generating stations. The Department of Scientific and Industrial Research, the Central Electricity Generating Board and other organisations have developed uses for the fine dust which forms most of the residue. But several million tons of this ash are produced each year, and much of it has to be dumped. Wider exploitation of the known applications, which include land reclamation (including land for agricultural use) and the manufacture of building blocks and aggregates, is obviously essential.

The dumping of urban refuse steadily becomes more difficult; finding sites for it presents a serious problem, and transport costs have mounted. It has been realised for many years that refuse disposal must inevitably be a growing embarrassment; it has been known too that replenishing the organic matter in the soil is imperative and that refuse can be the main constituent of a valuable compost. Other waste materials can contribute: sawdust, for example, can be mixed in with vegetable and fruit refuse, both household and industrial.

SITED NEAR THE SOURCE

The best product results, however, from the addition of another waste—the sludge from sewage disposal works. Mixing human waste with sorted household and agricultural wastes has been practised in India, and large-scale batch production of compost makes a valuable contribution to the market gardens of Jersey. Continuous processing is now possible: the Dano process, a Danish development, is being used with great success at Edinburgh, and an output of about 8,000 tons per year is expected from three biostabilisers (the name given to the large revolving cylinders in which the refuse and sludge are treated).

Proper application of such processes gives a friable clean-smelling compost, ready for use. It has proved to be very popular, and there seems to be no reason why the demand for the product should fall off. Extensive production would mean that plant would have to be sited carefully; presumably the composting plant would have to be sited near the sewage works. Unfortunately, the total quantity of refuse suitable for composting could utilise only a part of the sewage sludge at present being wasted.

It would be impossible within reasonable compass to highlight the many factors which aid or defeat attempts at profitable utilisation of the most common wastes. For example, many technical problems are involved in the reuse of paper. Modern industries require paper and board—in the form of sacks, cartons, labels, and so on—which have been treated with "wet-strength" resins, plastics, films, metal foils and other materials. These additives complicate the recovery process, and a small amount of them straying undetected into the pulping plant will ruin a whole batch of paper.

PAPER AND PLASTICS

Some papers containing these additives can be reused, provided they are segregated from the rest of the waste. Identification is often far from easy, and clearly an appropriate mark on paper products containing foreign matter would help the sorters at the paper mills. The British Waste Paper Utilisation Council is doing all it can to find a solution. The problem is obviously a pressing one; there is a real danger that paper technology, progressing rapidly, could outrun the ability of these concerned in waste recovery to segregate the various kinds of paper.

It has already been implied that waste plastics are reused and, in fact, many types of plastic materials and end-products can be put back into the manufacturing process. Yet there are thermosetting plastics which defeat attempts at large-scale utilisation and are not even suitable for use as a fuel. One or two varieties have been used in fertiliser and some, ground fine, may come in handy as fillers. These are limited uses, however, and the plastics wastes have to compete with materials which are technically superior.

A different kind of problem, involving a valuable commodity, arises in industries in which finishes are applied to products by spraying methods. Large quantities of overspray paint gather in the collection pits of spraying booths; this quickly hardens and is dumped. Manufacturers in the United States and elsewhere have successfully reconstituted the paint and have added it to new stocks. There has been little attempt to do this in the United Kingdom. If no one finds such an economy worthwhile the obvious alternative is to reduce the amount of waste, and this result can be achieved to some extent by electrostatic spraying and to a greater extent with curtain-coating using a continuously circulating paint supply.

A final word might be devoted to industrial effluents. The disposal of effluents so that they do not pollute our surface waters is a complex enough undertaking; extracting valuable substances from them may often be more difficult still. Recovery will sometimes be an economic proposition, however, and many authorities consider that wider use of modern methods of dealing with acid effluents and electroplating wastes can lead to really profitable waste utilisation. Ion-exchange, it has been claimed, is especially attractive in some industries for the recovery of valuable materials from solution—and water is not the least important of these.

BETTER HOUSEKEEPING

A scientific approach, with close cooperation between all concerned, can lead to practical benefits in many areas of industry. Numerous organisations are qualified to help, some with advice based on specialised knowledge and experience, and others with resources for extensive studies of disposal and utilisation problems. They include cooperative research associations, trade associations and DSIR. Merchants dealing in wastes know the value of the National Industrial Salvage and Recovery Council, which has the technical assistance of DSIR. But scientific investigation is not required for every problem: a little imagination and improved housekeeping can work wonders.

Innovations at the London Motor Show

Numerous changes in design, to give either better running or cheaper production, will be found on cars at Earls Court.

By Gordon Wilkins

ONE of the announcements held back for the opening of the London Motor Show was that of the six-cylinder engine which now equips a special version of the Standard Vanguard. Though Standard have been experimenting with "sandwich" engines designed for production from a series of pressure die castings, as in their Le Mans Triumphs, the company's new production six is a conventional cast iron unit with deep crankcase extending well below the crankshaft centre line. It is slightly undersquare, with bore and stroke 74·7 by 76 mm (1,998 c.c.). With a compression ratio of 8 to 1, it delivers 80 b.h.p. at 4,400 r.p.m., with a maximum net torque of 107 lb-ft at 2,500 r.p.m. The counterbalanced crankshaft with torsional vibration damper runs in four thin-shell bearings; the chain-driven camshaft is supported in five. The valves are set in line in bath-tub combustion chambers, using inserted valve guides in the head; unlike previous Vanguard engines, this one does not use cylinder liners. The head has 12 ports, inlet and exhaust being paired and two new semi-downdraught Solex carburettors of a remarkably compact type are mounted on an aluminium inlet manifold with two exhaust-heated hot spots.

Carburettor

The new Solex carburettor has twin float chambers which, combined with very short fuel passages, reduce the effects of surge and vibration, ensuring adequate flow to the jets at tilt angles up to 45° fore and aft and 10° sideways. The emulsion block carries main and pilot jets, pilot air bleed, main discharge well, emulsion tube, air correction jet, acceleration pump and injector. The Solex Econostat can also be incorporated and the emulsion block can easily be changed to convert the instrument from a pump to a non-pump type. The new throttle spindles are designed for multi-carburettor linkages which will require less frequent adjustment and the needle valve is much smaller than usual.

The Humber Super Snipe, which has been given four headlamps, is also modified in many mechanical details. Engine lubrication is improved by a larger oil gallery in the block and new drive gears to increase the pump speed and output. The front three main bearings are now steel-packed lead indium shells. A larger fan, with four blades instead of eight, gives better cooling with less noise, and a new baulk ring gives better synchromesh action in the manual gearbox. Suspension is improved by higher rated front coil springs of increased wire diameter and by rear leaf springs with blades 3 in wide instead of 2½ in.

Reducing Weight

The remarkable weight savings obtained on the American compact cars will cause many European designers to look again at their own methods. One thing is clear: further progress depends very much on cooperation from the suppliers of materials and components, and the results of a recent analysis, comparing the Renault Dauphine with a similar British small car, suggests that British suppliers of components and accessories still have a good deal to learn. The Dauphine saved 0·85 lb on the ignition distributor, 2·4 lb on the windscreen wiper and 6·4 lb on the heater. The tyres, though larger than those on the British car, weigh 5 lb less, a saving in weight of 25 lb per car on tyres alone. The Dauphine tyres have a carcase which is only two-ply and wall troubles are not unknown in severe service, but this is not the only case where continental manufacturers have obtained a useful weight saving in this department.

Windows and window winders also show some surprising figures. The window winding mechanism weighs 4 lb on the Dauphine against 10·1 lb on the British car. But there is also a big difference in the weight of glass, the figures for the front door drop lights being 6·5 lb and 15 lb respectively. Part of this was accounted for by the larger glass area on the British model, but the Dauphine also uses thinner safety glass than can be obtained from some of the major British suppliers: 0·168 in against 0·187 in. Other savings on carpets, trim and seat cushions, added to those obtained from the use of unusually thin-gauge panels on the body of the Dauphine, emphasise the painstaking work on every component which is necessary if appreciable reductions in weight and cost are to be obtained on small cars.

Endurance of the Vauxhall Victor engine has been increased by the use of Glacier aluminium-tin bearings, which are also used on Perkins and other diesels.

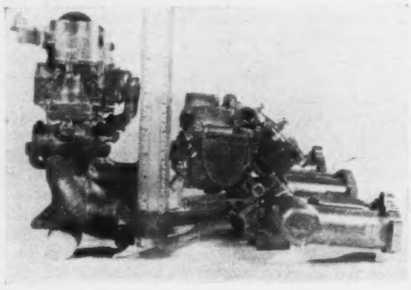
Flexible Shafts

It was to be expected that the Americans would find some ingenious ideas in their efforts to produce smaller cars and there is none more spectacular than the flexible drive shaft on the Pontiac Tempest. Using a front engine, but removing the gearbox to the rear, they had a drive shaft which had only to transmit engine torque at engine speed. A quill shaft has therefore been used which is so slim and flexible that it would have curved about 0·4 in out of true at the mid point under the influence of its own weight. Pontiac increased this curvature to 2 in by means of intermediate rubber-mounted bearings and the shaft runs in this condition without universal joints. The centre tunnel in the floor is thus reduced to a small dimension.

The drive shaft is made of torsion bar steel, heat treated, ground all over to a diameter of 0·65 in and shot peened. It exercises a useful damping effect on the torsional vibrations from the big four-cylinder engine. It runs inside a light steel box member of top hat section which is useful to unite the front engine and rear transaxle as a subassembly but does not contribute anything important to the rigidity of the body structure. Inside the box member are the two sealed ball bearings in rubber mountings which control the curvature of the shaft.

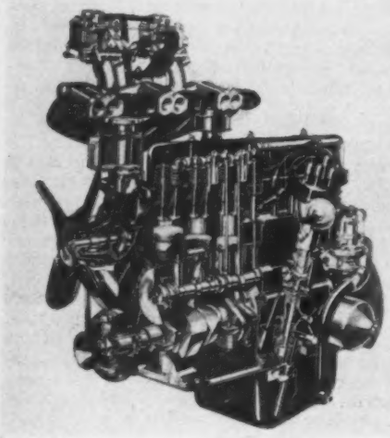
No-lubrication Chassis

Durther progress is being made towards the ideal of the car which needs no lubrication or maintenance throughout its service life. Cadillac announce that their 1961 models need no chassis greasing. Rover have adopted a propeller shaft with sealed bearings for the 3 litre model, so that there is now only one grease nipple on the chassis, lubricating the propeller shaft sliding splines. But the cost of ptfe at £6 per lb is still a deterrent to the makers of low-priced cars when seeking to avoid chassis lubrication. It has to be used as a very thin film on the joints and pivots, and the film has to be protected against road mud and grit and, as one designer put it, "the simplest way to keep out the weather is to inject some grease." However, Standard-Triumph report that a year's experience with abolition of routine greasing on the Herald has fully justified the move. On some early cars, needle rollers in the rear hubs gave trouble because of a faulty oil seal, but this was soon cured. Steering on the Humber Snipe has been improved by Glacier ptfe bushes for the kingpins.

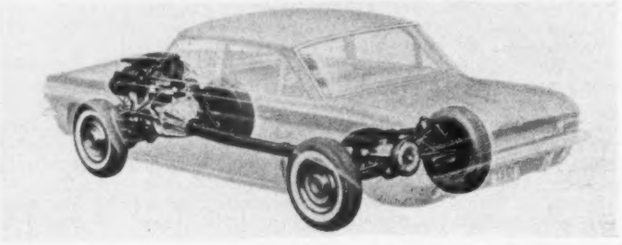


The new compact Solex carburettor.

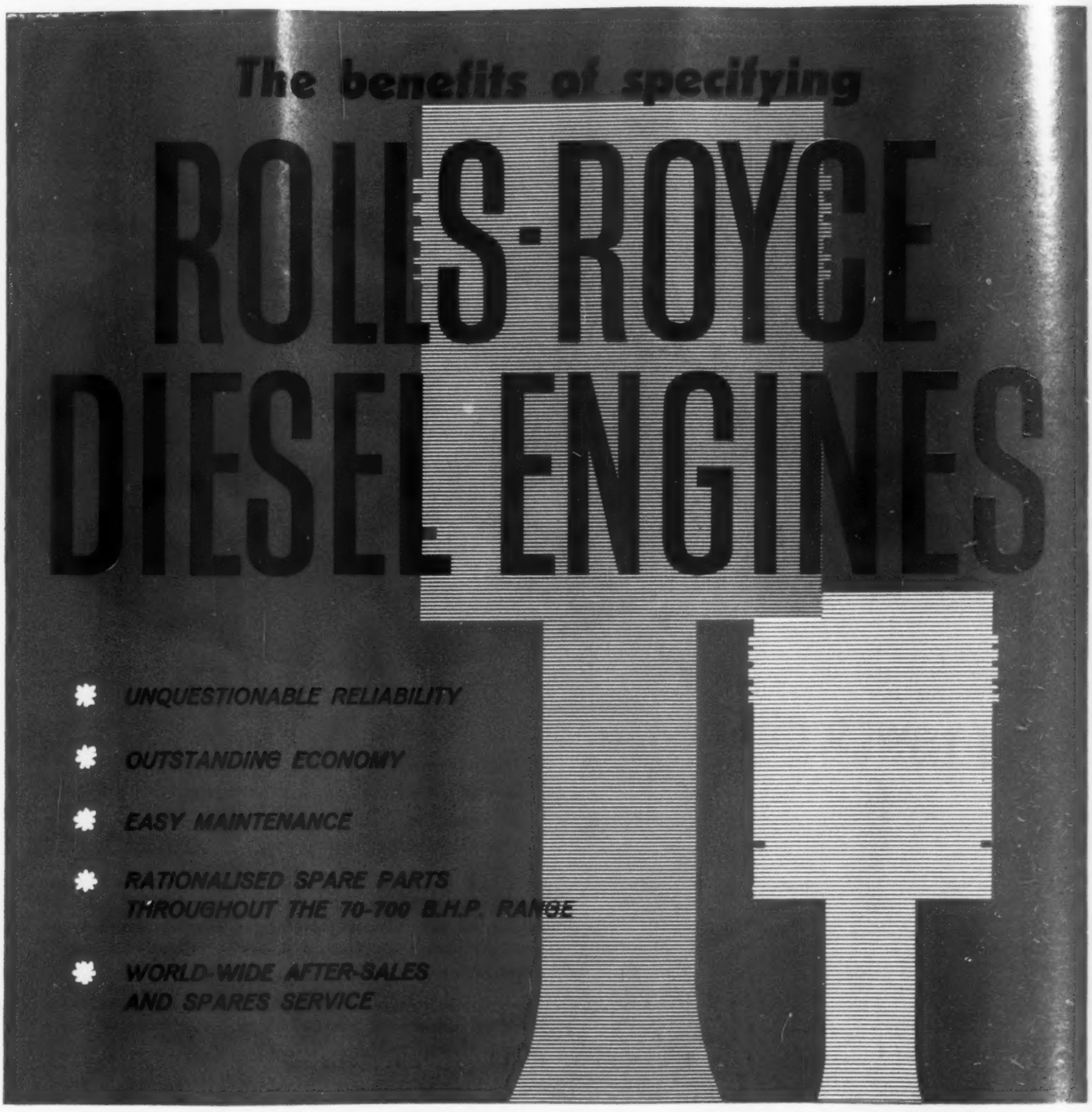
Humber Super Snipe with four headlamps.



(Left) The new 1,998 c.c. six cylinder engine for Standard Vanguard.



(Right) The Pontiac Tempest which has the gearbox at the rear.



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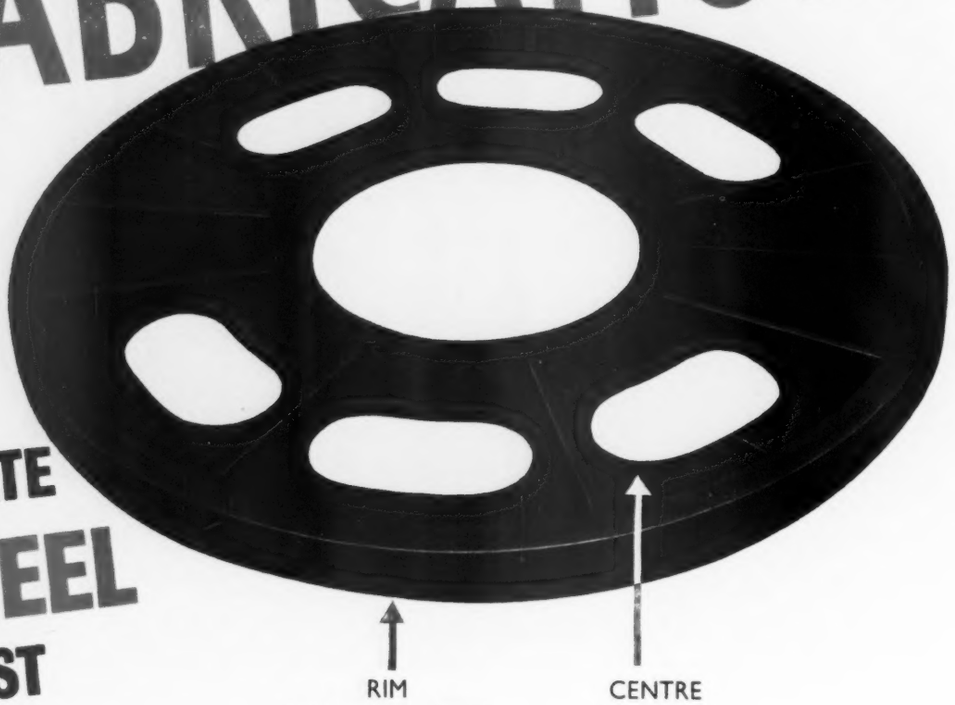

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Human Element

Dreams as a Basis for Industrial Planning

EASILY the most looked forward to speaker at last week's conference of the British Institute of Management at Harrogate, Yorkshire, was Dr. Ernest Dichter, the famous American protagonist of motivational research. Dr. Dichter is known among many in the United Kingdom as the man who drew strange conclusions from the sort of thoughts that went through a man's mind when he looked at a convertible in a car salesroom window.

At Harrogate, Dr. Dichter had another instructive tale to tell, this time in connection with scooters, the German NSU car firm, and the dreams of the increasingly prosperous German worker.

Dr. Dichter had been called in by NSU to give marketing advice. The company's engineers had produced the Quickly scooter and they were justly proud of its splendid design: the Quickly would last for years, cost practically nothing to run, was extremely reliable and easy to maintain and did not have to be licensed. All this the company was saying, and loudly, to the potential customer and it was doing sales no good at all.

Bicycle into Car

Dr. Dichter explained to his large and closely attentive audience exactly why.

The Quickly was being put over as a bicycle with the work done for the cyclist, as being cheap to run, and as being very long lasting. This was not what the German worker wanted at all.

Every year he was growing more prosperous. Every year, he dreamed, he was a little nearer owning his own motor car. Savings towards the family motor car were mounting and the day of release from the bicyle was visibly approaching.

It was no good at all the NSU company coming along and condemning him to more years on the bicycle, powered or not. Dr. Dichter is not the president of the Institute of Motivational Research to no effect. He advised NSU to make radical changes.

The German worker was dreaming of a car. The Quickly scooter should be sold as a car, or at least as a step towards one. Therefore, off with the bicycle bell. A hooter was substituted. Wide tyres were used and the scooter was designed to be nearer the ground and more rounded in appearance.

Licence Appeal

A crucial point came up over the licence. The Quickly scooter was not licensed. This freedom from taxation was no advantage. The motor owner paid a licence fee and therefore if a licence had to be paid on the scooter it was one more sign of a step in the right direction.

The company's message became, not "Here is a super bicycle" but "Why wait to get a car, buy a Quickly." To back this up the company conducts a trade-in programme so that when the Quickly owner is ready to buy his first car, if he does not want to keep the scooter as well the company will accept it in part payment.

Away with the Management Trainees

A sad picture of the fate of the graduate who leaves his university flushed with success at the selection board and intent upon a rapid climb to "captain of industry" status, was given in an opening session of the conference by two men both well informed in this particular field.

They were Mr. Tom Roberts, education and training officer of the Beecham Group, and Mr. John Tyzack, chairman, John Tyzack and Partners.

The graduate knows little about business and he does not know what he wants to do when he joins his first company. These were two assumptions central to Mr. Roberts' argument and there was no sign in the discussion among the conference delegates that any seriously disagree.

There is a tendency among firms to draw up training programmes which last from three months even to two years—"rotating their young men round the various departments."

This leads to much waiting around with nothing whatever to do, too much study of the appointments page of the *Daily Telegraph*, and to suspicions that in all other companies the grass is distinctly greener.

Mr. Roberts described this as: "periods of alternating boredom and frustration interrupted by short bursts when he is given routine tasks to perform. It is very soul destroying. Regarded in the departments through which he passes as a bird of passage, seeking out other graduates in order to overcome loneliness, and possibly resented by managers who "came up the hard way," the management trainee obviously gets little benefit from this state of affairs and, although Mr. Roberts did not say it, it may be wondered what benefit the company is getting.

Responsibility Seekers

What the graduate was looking for when he came into industry was a chance to accept responsibility. Very often this was the last thing that happened to management trainees.

From all this Mr. Roberts deduced that restlessness—"is a very natural phenomenon amongst graduate trainees and if companies persist in operating rotational training it is equally natural that graduates will find themselves intellectually under-employed."

To Mr. Roberts, who carried a large measure of supporters with him, it was self evident that industry should think again about management trainees.

"First of all, I think we should scrap the term and admit that we are recruiting university graduates not to train them into managers, but to make them into junior executives, and that they will become a part of the reservoir from which our future managers are to be developed. They should be recruited for a specific job, put in that job from the word "go," and given the kind of training which is essential to the efficient performance of the job. If our selection has been right, the graduate entrant will have a place in the company, will be accountable for the work he has to do, and will have a chance to show his capacity for assimilation and application. Naturally the kind of job we place him in is important, whether as an assistant in the marketing department, in buying, production planning, or elsewhere, and it must demand intelligence and be such as to give the young man a basic grounding in one key activity of the company. He should not be moved from it until he has demonstrated his competence, and his future development should be catered for by the company's Executive Development Programme like every other promising junior executive."

A First Step to Unite the Engineering Profession

The proposed amalgamation of the Institution of Civil Engineers and the Institution of Municipal Engineers is not an isolated action. For four years now the ICE Council have been considering what their President, Sir Herbert Manzoni, calls "the reunification of the profession" and it is a reasonable long-term expectation that if and when the merger with the Municipals is complete similar action will be begun in connection with other bodies whose work is closely concerned with civil engineering.

Both councils of the two institutions have now approved the terms of amalgamation. Voting forms and details of the formal agreement have been sent to the 17,000 corporate members of the ICE and the 6,000 corporate members of the IME.

Following the postal vote for or against amalagmation, the necessary supplemental charter, new by-laws, admission and disciplinary regulations, there is to be a special general meeting at which resolutions approving the amalgamation will be put. The response to the ballot is important not only for the purpose of securing approval for the move but because approval has to be granted by the Privy Council, who can be expected to take account of the way the voting goes.

In his letter to members, Sir Herbert Manzoni writes: "The ultimate aim should be that of one society of professional engineers whose members should be Chartered Engineers."

Describing the process by which new specialist organisations spring up to provide discussion facilities and then go on to become qualifying bodies, the ICE President observes that the engineering profession has "suffered" from a good deal of fragmentation and from splinter groups.

These specialist groups are inevitable as industry becomes more complex and specialised. What the ICE Council is now to try to do is to provide the services for discussion, meetings and so on—"under the aegis of the Institution."

Sir Herbert makes the point that one society of engineers would eliminate the confusion created by the adoption over the past 100 years of a multiplicity of titles for professional engineers.

The ICE was formed in 1818 and is the oldest of its type in the world. The IME was founded 55 years later, in 1873. Four years ago the two bodies took an important step towards eventual amalgamation when the Municipals decided to take part in the Joint Part I examination of the Engineering Institutions. Discussions of a merger have been going on ever since.

Support for Marketing but How Much Knowledge?

An opinion poll at the BIM Conference for or against marketing would undoubtedly produce an overwhelmingly favourable declaration in its support.

Mr. Colin McIver, chairman of Market Development Limited, said he thought this would be so and there is no doubt he was right. If the same poll had asked what marketing was, it is almost certain that no two answers from the hundreds of delegates would have been the same.

The best approach to export marketing was to think not of selling for export so much as of generating demand in export markets—to create conditions that will pull goods out of the domestic factory rather than attempting to push them into the export market. Provided he was the right man, Mr. McIver had a very strong belief in the man on the spot.

At a time when the Board of Trade is almost overwhelmed with requests from British Companies for help in appointing overseas agents and representatives Mr. McIver's point is of added importance.

"If you want to sell your goods in Germany or in Ghana, and have reasonable evidence that there is a potential demand for them there, I don't think the answer is either just to strengthen your export department in Birmingham or to appoint an agent in the country concerned who already handles a dozen other agencies.

This is obviously a policy that costs money, as Mr. McIver underlined, the market must have sufficient potential to justify the outlay. He thought it might be necessary to begin with a consortium of companies rather than leaving the bill to be footed by one single firm.

All the speed of modern communications does not make it possible to get to know a market at long range or by periodic visits. Mr. McIver gave an example of a firm being ready to safeguard its existence and future expansion by setting out to make what was wanted, rather than struggling to sell what it traditionally produced. His example was drawn from an engineering firm with a strong heavy industry interest.

Sticking to the Policy

The company decided three or four years ago to build up its interest in consumer durables. The firm assembled a team of men with marketing experience, mostly in food, soap, toilet supplies and other consumer industries. There were centres of opposition in the concern, particularly among the engineers of long standing. There appeared at first to be justification for their doubts and objections. After a year or two of reorganisation and product development what had been a modest profit in the consumer division had turned into "a handsome loss" a big enough loss to have frightened a weak management into calling the whole thing off.

"But top management was strong and persisted," said Mr. McIver. In the third year the work of reorganisation was completed—just in time to catch the consumer durable boom. With less than 10 per cent of the turnover, the division made a quarter of the profit.

CONTINUOUS ANALYSER

for Silica Concentrations

SILICA concentrations in feed water down to one part in a billion can be detected by the AutoAnalyser.

The continuous operation of the instrument allows demineralising plants to be run automatically. Any rise in the silica content can be used to initiate an alarm or to switch the system from one resin bed to another.

Samples are placed in plastic cups on the sampler plate without having to be accurately measured. For the analysis of a flowing stream, the plate is dispensed with and the sample is fed direct to the mixing cell. This is equivalent to a mechanical shaker and ensures an even mix. The proportioning pump has peristaltic action by the compression of plastic tubes with rollers against a platen. Tubes are available in various sizes to suit the rate of flow required. Up to eight reagents can be handled simultaneously by the pump.

Next in sequence comes the dialyser whose function is to obtain a pure sample covering precipitation, filtration, etc. Sample and control are treated identically. In the heating bath which comes next in line, the sample is heated to obtain a standard colour reaction. Again the action is automatic and sample and control are treated identically. Last is the colorimeter where sample and control are checked at a specific wavelength in the same flow curvette. The results are then automatically plotted by a recorder either on a moving chart or as a linear function requiring no interpretation. A third method is to produce the results on a printed tape expressed directly in terms of milligrams per cent.

Other trace elements can be detected in the equipment using suitable reagents, such as phosphates ammonia, hardness, hydrazine, and chromates. The separate units allow a flexible set up. *Technicon Instruments Limited, 26 Warwick Road, London, SW5.*

CENTRIFUGAL PUMP

Solids up to $\frac{3}{8}$ in

THE Fasprime Mk 14A is a 3 in centrifugal pump with semi automatic priming.

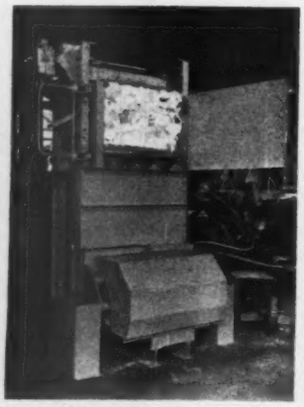
Power is supplied by a Lister LD air cooled engine to give a delivery of 8,100 gallons per hour against a head of 70 ft with a maximum suction lift of 27 ft. With an SL1 engine the output is increased by 10 per cent and the delivery head by 50 per cent.

The pump is a robust unit for rigorous conditions. The semi automatic priming assures rapid priming and high suction lifts. A newly fitted speed control enables it to operate economically and continuously under snore conditions when the lever is set to " prime." The seal has two separate faces both of which form part of an oil filled chamber. Gritty water is excluded and while one face seals against pressure the other seals against vacuum during priming and on high suction lifts.

Solids up to $\frac{3}{8}$ in diameter, the size of the holes in the filter, will pass through the pump without damage. The four bladed open trash type impeller is of spheroidal graphite cast iron as also are the housing and the renewable backplate. All are entirely enclosed in the pump body. The pump is directly flanged and spigotted on to the engine and the whole mounted on two channel iron bearers. With its cushion wheels the unit is easily transported about the site. All wearing parts are individually replaceable. *C. H. Johnson (Machinery) Limited, Adswood, Stockport, Cheshire.*

BALING PRESS

Vertical Model



ONE of a range of vertical baling presses for rags or paper is shown in the illustration.

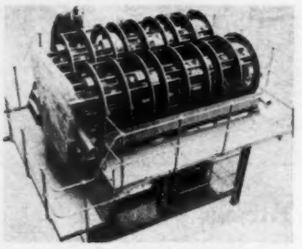
There are three sizes available and all can be made to accommodate either top or side feed. The former is usually preferable as it gives a higher output. These presses are mechanically operated by a wire rope running round a scroll of varying diameter. By this means a quick travel is given to the platen when the pressure is first applied, graduating to a slow motion at intense pressure towards the end of the stroke. Pressure is automatically held during the wiring of the bale.

The completed bale may be removed through either door by operating the side release which allows one side of the box to move out, and lowering the platen a few inches. The presses are normally supplied for electric operation but other types are available.

On the electric type the operation is controlled by push buttons with limit switches to govern the travel of the platen. The pressure is sustained by an electromagnetic brake. Mechanical protection is afforded by an instantaneous overload device. The three sizes are designed to handle bales of paper weighing 2 to $2\frac{1}{2}$, 3 to $3\frac{1}{2}$ and $4\frac{1}{2}$ to 5 cwt. *Heenan and Froude Limited, Worcester.*

CONCENTRATOR

for Dewatering Sludges



BEING manufactured in this country under licence is a range of sludge concentrators.

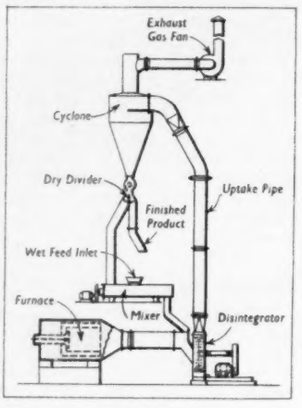
There are two main units in the equipment and they operate in series. The first is the Roto-plug thickener and the second is a compression filter. The Roto-plug is a freely rotating cylinder fitted with a special nylon woven filter medium on the cylindrical surface; it is continuously fed by a sludge feeder. Initially natural drainage occurs resulting in a deposit on the filter medium. The rotation of the cylinder causes this deposit to form into a rolling mass which further dewaters the primary deposit by the action of its own weight. As the mass " snowballs," the end portion is cut away by the end flanges and drops on to a conveyor.

In the compression filter the sludge again falls on a cylindrical drum but this time on the outside. Rollers press it against the drum and more water is extracted by the mechanical pressure. This second operation results in a friable cake containing from 25 to 35 per cent of dry solids by weight according to the nature of the original sludge.

Advantages claimed are low initial cost; low power consumption—a concentrator handling 210 lb per hour of dry solids requires $3\frac{1}{4}$ h.p.; absence of chemical treatment; low installation costs; and the production of a dry cake irrespective of ambient conditions. A range of sizes is available. A model fitted with four Roto-plugs occupying a floor space of 11 ft by 5 ft and standing 10 ft 6 in high will dewater primary sedimentation sludge from a population of 20,000. *Davey, Paxman and Company Limited, Colchester.*

FLASH DRIER

Hot Gas Stream



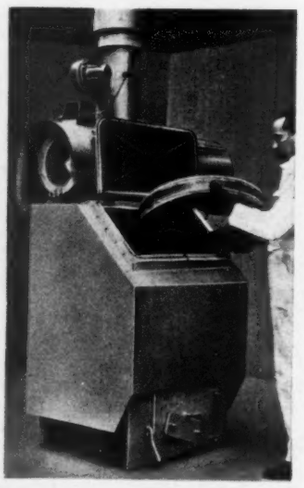
RAYMOND flash drying equipment now available in this country is designed to remove definite amounts of moisture from damp granular or fibrous material.

There are three possibilities: the material can be dried without disintegration, with disintegration, or with pulverisation. Hot gas, supplied either by direct firing, indirect heating or the use of waste gas, passes to the disintegrator or pulveriser (if required) and so carries the material up to the cyclone. Wet material is fed to the mixer where it is blended with a controlled amount of material that has already been dried. The resulting product can easily be picked up by the gas stream. The dried mixture then enters the cyclone collector and the moisture-laden gas is exhausted to atmosphere by a fan.

The divider in the down line proportions the feed to the mixer and dispatches the remainder to the discharge opening. The operation may be either manually or automatically controlled. Thus the finished product is obtained in a dust-free plant operating under suction, and the particle size can be accurately maintained. Typical materials for which the equipment is suitable include coal cake, sewage sludge, chemicals and fertilisers. *International Combustion Products Limited, 19 Woburn Place, London, WC1.*

INCINERATOR

With Water Heater



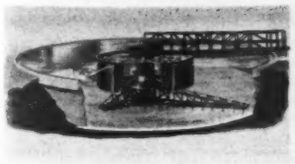
CLAIMS for the Hoskisson incinerator are that it will consume all types of rubbish, including rubber and plastics, without producing any smoke or smell.

The Mark II model includes a hopper feed to facilitate loading and can be fitted with a water heater instead of an air heater. The heater can be used alone or connected into the existing hot water system of the plant so making a substantial saving in fuel costs. A gas fired smoke eliminator can be fitted in place of the oil fired version if desired, allowing a wider range of applications for the unit.

An automatic space heating oil burner unit is an attachment for the basic model which is self contained and can be placed in any suitable site in the works. The illustration shows the method of hand loading. Ash is removed from the door at the bottom. The makers claim for the unit (in their guarantee) that it will give smokeless combustion when fired with any type of combustible material and that it complies with the Clean Air Act. *Boston Marine and General Engineering Company Limited, Heath Town Works, Deans Road, Wolverhampton.*

SLUDGE COLLECTOR

Pre-aeration and Settling



RECENT additions to the Circuline range of sludge collectors are the models in series A for settling and aeration.

There are two models in the series; type AP which is designed for preliminary aeration and AT for total aeration over a period of 24 hours. The tanks are designed to remove mechanically the scum that forms on the surface of the liquid as well as the heavy organics and grit that settle on the bottom.

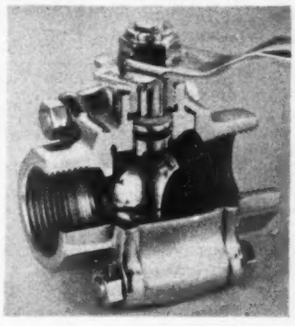
Series A collectors consist of a single circular tanks in which aeration and settling are accomplished. The collecting mechanism is similar to that used in other models and it removes solids settled from both the aeration compartment and the settling compartment. The scraper unit has a trussed girder arm extending the whole width of the tank. On it are scraper blades set at an angle so that the outer one scrapes the edge and deflects the sludge towards the centre. Each succeeding blade overlaps the preceding one so that there is a continuous movement of collected sludge to the middle where there is a hopper. From the base of the annular hopper a pipe carries the sludge away assisted by a pump to the discharge point.

Type AP provides an aeration of from 30 to 60 minutes confined to the centre compartment of the tank. Settling takes place in the outer compartment. Air at the rate of ½ cu. ft per minute per gallon of sewage is sufficient to remove up to 70 per cent of suspended solids and up to 50 per cent of biological oxygen demand.

Type AT provides total treatment with extended aeration periods of up to 24 hours. Here the aeration occurs in the outer ring and the settling compartment is at the centre. Up to 90 per cent of solids and B.O.D. can be removed by air at the rate of 1 to 2 cu. ft per minute per gallon. *Link-Belt Company Prudential Plaza, Chicago 1 USA.*

BALL VALVE

Many Materials in Seatings



NOW being made available in this country is the Econ-O-Miser range of ball balves previously marketed in the United States.

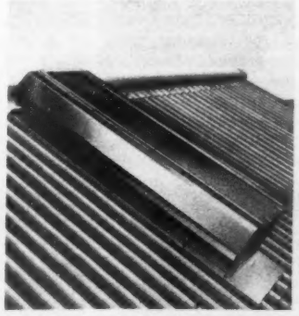
The valves will be made in eight sizes, these being ¼ in, ⅜ in, ½ in, ¾ in, 1 in, 1¼ in, 1½ in and 2 in bore. The body may be made of bronze, carbon steel, or stainless steel to suit any particular application according to the properties of the material, and the seating is also available in a wide range to suit the fluid being handled in the system.

Seat materials currently used include synthetic rubbers such as Buna-N and plastics as nylon or ptfe. As a result it is possible to use these valves in positions previously occupied by gate, flanged gate, diaphragm, and lubricated valves. This enables a smaller variety to be employed with reduction of spares and stock to be carried. The makers suggest that by careful choice of body and seat materials, these ball valves could be used for four out of five cases where on-off valves are required.

A special claim for the valve is that owing to its method of construction it also serves the purpose of a pipe union. There are detachable pipe ends which screw to the pipe and bolt to the valve, allowing the latter to be removed for maintenance without any disturbance of the pipework as a whole. Four bolts are used and the seals to the flanges are made with O rings. *Worcester Valve Company Limited, 62 Church Road, Burgess Hill, Sussex.*

ROOF VENTILATOR

Glazed Top



GLASS in the top of the Glazed-Top Roofline extractor increases the amount of light that can enter the building.

The extractor can be used on either flat or sloping roofs. It is of aerodynamic design, with a large unrestricted outlet area to give maximum ventilation. The internal and external baffles are arranged to make the unit weatherproof and sealer strip fitted round the glazed edge makes a watertight joint.

It is claimed that its lightweight construction and the easy handling of the unit make it simple to instal. It stands 14½ in high. Mounting can either be on glass or on any type of corrugated sheeting with the minimum use of trimmers. The units are made of heavy gauge hardened aluminium riveted an welded. Reinforced cast wired glass is fitted.

Manually controlled or thermostatically operated fibre glass shutters can be provided, which are opened and closed by an electric motor, where heat conservation is important. *Greenwood's and Airvac Ventilating Company Limited, Beacon House, Kingsway, London, WC2.*

The water pressure of 25 lb per sq. in given in our item on the Ditchburn vending machines (26 Aug. '60, p. 270) is the operating pressure of the filler. The break tank and pump incorporated in the machines render this pressure unaffected by supply variations and give a constant filling of the cups. The same coin operating mechanism is being used.

VOLUMETRIC FEEDER

For Dry Materials

DRY materials can be metered accurately into a process by the Vibra range of screw feeders.

The feeders incorporate a screw mounted on a vibrator in such a way that the screw, screw trough, bearings and discharge tube vibrate as one assembly while the screw rotates. Feed rates are proportional to the speed of rotation of the screw and are infinitely variable over a range of approximately 50 to 1.

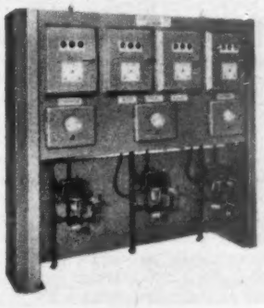
The standard range of feeders consists of 10 graduated sizes having screws from ¼ to 4 in diameter and providing feed rates from a few ounces to several tons per hour. The vibratory action overcomes sticking, bridging and flooding and a constant level of material is maintained over the screw to eliminate feed rate variations. The controlled vibration also reduces the material to a constant density before entering the screw, which again makes for accuracy of delivery. It is claimed that with most materials deviations in feed rate are kept to within 1 or 2 per cent from minute to minute giving long-term accuracy.

It is also claimed that the machines will handle fine powders, flakes, and pellets without degradation taking place, and crystalline materials can be handled without breaking down.

The standard machines are constructed in mild steel with the screw and discharge tube of stainless steel. Aluminium and plastic finishes can also be supplied to meet specific chemical and other requirements. The illustration shows the 3 in model and the method of connecting the hopper to the screw chamber. *Simon Handling Engineers Limited, Cheadle Heath, Stockport, Cheshire.*

DETOXICATION PLANT

Cyanides and Cromates



A COMPLETE system for the automatic treatment of cyanides and chromate wastes from galvanising, plating and heat treatment baths can be built up from standard items.

In the plant, the waste water is automatically adjusted to the required pH value and is then passed through a rapid reaction tank of special design into which the appropriate reagent (depending on whether cyanides or chromates are concerned) is added under fully automatic control. The state of the reaction in the continuous flow tank is monitored by an electrochemical detector which is connected to an electronic amplifier and reaction controller; this regulates the gas addition device (for example, the chlorinator) or controls a liquid reagent valve adding, for example, sodium hypochlorite.

Self-contained packaged units are available for flows up to approximately 2,000 gallons per hour. For higher flow rates the reaction tank is built separately from the instrument cubicle. The final effluents from either cyanide or chromate processes are neutralised under automatic pH control to bring them within the required limits.

Claims for the plant are minimum space requirements; continuous monitoring; reliable detoxication with varying concentrations; and economic use of chemicals giving low operating costs. *A. M. Lock and Company Limited, Prudential Buildings, 79 Union Street, Oldham, Lancashire.*

DIAPHRAGM PUMP

Chemicals and Slurrie

LATEST addition to the Linatex range of diaphragm pumps is a 1 in model.

The new pump has a capacity in the range from 30 to 120 gallons per hour at heads up to 25 ft and suction lifts of 10 ft. The stroke is adjustable to a maximum of ⅞ in and the hose connections are 1 in on both suction and delivery sides.

The motor drives the pump through reduction gearing. The whole of the pump body is lined with Linatex rubber making it suitable for handling corrosive liquids and abrasive slurries. It also prevents metallic contamination of the liquids inside the pump. Solid Linatex valves and diaphragm are also used. Stroke adjustment in the crank arm is provided and needle bearings in the connecting plates make for trouble free operation with long life. The vertical mounting of the motor allows various types, including flameproof models, to be fitted to the standard gear unit.

Accessories available include suction and discharge hoses; hose coupling pieces and hose clips, and a dip pipe for emptying barrels. Chief claims are the positive action; absence of packing; simple operation; self priming; and the generally robust construction. *Wilkinson Rubber Linatex Limited, Camberley, Surrey.*

Riches Are Recovered from Urban Refuse

Last year £3 million of salvaged material was recovered and sold by 465 of the larger urban authorities, some of which employ highly mechanised plants. Sewage also yields considerable wealth.

By A. E. Higginson, M.Inst. P.C., M.I.T.A.

Superintendent of Public Cleansing, Chesterfield

IT IS not generally realised how great a part is played by local authorities in salvage recovery from refuse and to what extent mechanical plant and equipment is used to handle and process the segregated materials. From the last published official returns we find that in 1959 £3 million of salvaged material was recovered and sold by 465 of the larger urban authorities. This is an impressive figure in monetary terms, but the tonnage of potential raw materials such as waste-paper, scrap metal, polythene, bones and so on is equally impressive. It means that industry has the benefit by receiving substantial tonnages of raw materials for conversion and processing purposes at fairly low cost. It also strengthens the country's economy by utilising these commodities without recourse to additional imports to cover deficiencies in supply problems of raw materials.

In order to recover substantial quantities of salvage from refuse many authorities have installed robust machinery and equipment to facilitate extraction from what might be described as an abrasive and heterogeneous material.

The most up-to-date and largest disposal works in Britain for the mechanical separation and incineration of refuse is the City of Glasgow's Polmadie Works which has a capacity for dealing with 600 to 800 tons of refuse daily. To handle such a vast quantity of refuse two shifts are worked with an intake of 300 to 400 tons per shift. By careful design the plant is divided into four independent units with 75 per cent in constant operation and the remainder being available for regular maintenance purposes.

AUTOMATIC HANDLING

It is perhaps desirable to indicate the methods used for conveying a huge tonnage of refuse through the plant and extracting enormous quantities of salvage in the process. On arrival at the works the vehicles discharge into reception hoppers and then the refuse is elevated by conveyors to rotary screens for the removal of dust and cinders. The latter pass over garbage separators for cleaning and are transferred by belt conveyors to outside concrete storage hoppers. Hydraulically operated doors allow for rapid discharge of the materials to vehicles waiting below. Passing from the primary screens the remaining refuse is transferred to horizontal sorting belts where the salvagable items in the main are recovered. Tins and ferrous scrap are initially segregated by electromagnetic separators fitted over the sorting belts, as shown in Fig. 1, and secondly by magnetic pulleys situated at the head of conveyors. The tins and ferrous scrap are discharged to hydraulic scrap metal presses for baling into briquettes. From the wide conveying sorting belt employees pick off paper, cardboard, textiles, bottles and similar items, which are also transferred to a central section of the works where further sorting and baling is carried out. The recovery of certain items during the year from the Polmadie Works indicates the scope of salvage activity: scrap metal 4,416 tons, textiles 184 tons, bottles 12,830 dozen and cinders 1,830 tons valued at £32,730.

DUST CONTROL

The brief remarks above cannot fully convey the fascinating movement of a heterogeneous mass of material passing through its preliminary stages for the recovery of valuable salvage to its ultimate destination at the furnaces, but it is a triumph of engineering skill in mechanical handling of a difficult material. Throughout the various phases of handling great care has been exercised in the control of dust arising through disturbance of refuse. This ensures better working conditions for the employees concerned and emphasises the value of dust extraction at points of discharge around the works. A glance at Fig. 2 shows the use of conveyors feeding refuse to the furnaces by a system of belts which allows the flow to be directed to any incinerator cell.

The electromagnetic separation of ferrous metals from refuse is an important feature of mechanical disposal plants as the percentage to be recovered is between 5 and 6 per cent of the total refuse handled. In Chesterfield the tins are extracted with an "Overband" electromagnetic separator which lifts the tins from a 36 in conveyor belt carrying crude refuse running in troughing idlers and deposits them into a chute where they are fed directly into a Heenan and Froude hydraulic metal baler, shown in Fig. 3.

The tins and other light scrap are compressed to form briquettes weighing 60 to 80 lb each, according to the type of material handled, and having an overall size of 18 in by 12 in by 9 in. The ram head pressure exerted by this hydraulic press is 34½ tons with a pump capacity of 10 gallons per minute at 2,000 lb per sq. in. The finished bales are loaded into railway trucks for dispatch to blast furnaces. This single hydraulic press, which has an output of 900 tons per annum, is capable of handling all the tins and light scrap collected, and compressing the material into bales during a normal working week.

Textiles removed from the picking conveyor belts are sorted into various grades, baled and dispatched to separate works for processing. There are many hundred grades of rags, but councils generally confine themselves to roughly twelve grades. The wiping rags used so extensively in engineering works may have had their origin in the cotton rags sent for processing by local authorities. Woollen rags are dispatched to mills for conversion into cloth, mixed rags into felt, ropes and string for paper making, low grade rags for roofing felt and damp-proofing of buildings. From the picking belts scrap rubber is removed for conversion into new products, bones for grease, soap, feeding meal and fertiliser. Non-ferrous metals which are unaffected by the electromagnet are also picked off, sorted and sent to scrap merchants for refining. Light aluminium pots and pans with iron handles are sometimes lifted out by the electromagnet and thrown down the baling chute, but the baling press operator observes these objects before compressing the ferrous scrap, and places them on one side for recovery.

It might cause surprise in view of the comparative high cost of coal to find how many tons of good cinder are recovered from domestic refuse in mechanical disposal plants. The figure for Chesterfield is 1,200 tons per annum and these are removed by passing the refuse through a single barrel rotary screen 5 ft 8 in diameter and 23 ft 6 in long fitted with mesh-plates which allows the cinders to fall on to a

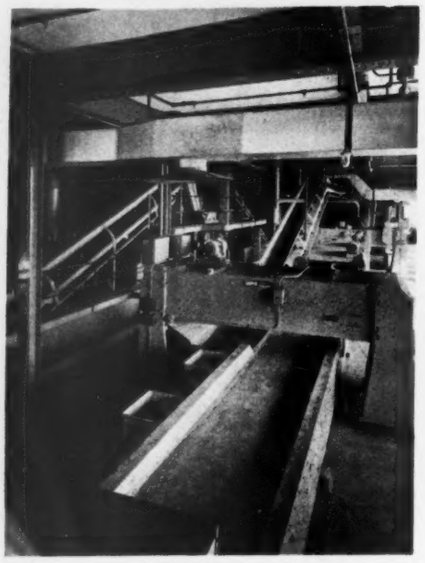


Fig. 1 Heenan and Froude Rapid electromagnetic separator in Glasgow's Polmadie disposal plant.

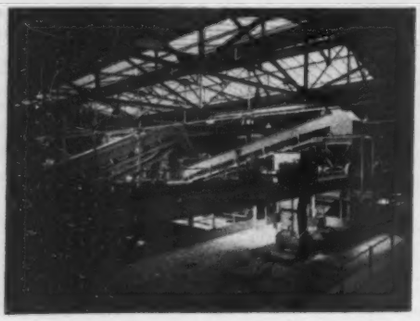


Fig. 2 Incinerator house, showing tailings conveyors and mechanical discharge of refuse to cells.

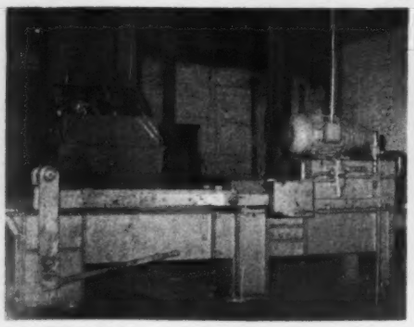


Fig. 3 Hydraulic metal baler made by Heenan and Froude for the Chesterfield Corporation.

Fig. 4 A waste paper mechanical handling plant has been installed by Chesterfield Corporation.

rubber elevating belt and be fed through the cinder cleaning plant and thence to a 10 ton storage hopper with doors opening directly into waiting vehicles. The recovered cinders have a calorific value of about 9,000 Btu's and are supplied to nurserymen for greenhouse heating, to cement works and to laundries in place of other fuels, and are also used internally for hot water supplies to employees, central heating of workshops and other purposes. There is a considerable demand for cinders in stock brick making as the "breeze" is used for firing the bricks, giving them a characteristic colouring.

The largest items of income in the recovery of salvage from local authorities sources is wastepaper and cardboard. This constitutes a very bulky material which must be separated into grades such as mixed waste, fibreboard containers and newsprint. To facilitate sorting, handling and baling economically a wastepaper handling plant is desirable. This plant comprises a push-on feed at floor level and as the paper is being elevated provides a comfortable height for sorting. Dust and contraries are automatically deposited in dust trays and removed at the end of the day. Steel chutes connect the elevators to a continuous baler and a roller conveyor carries the completed bales off to the storage bays. A typical plant embodying these principles has been installed in Chesterfield, as illustrated in Fig. 4, and works most efficiently, the tonnage handled annually on this one machine is 1,550 tons during a normal working week of 44 hours. There is reserve capacity in the layout for a further 500 tons per annum which is the anticipated increase in the next 5 years.

The intensive recovery of waste materials for conversion purposes, particularly among local authorities, means a considerable reduction in the overall cost of refuse disposal and at the same time returns to industry raw materials at reasonable costs.

. . . . and Wealth from Sewage

By A. E. J. Pettet, M.A., F.Inst. S.P.
Assistant Director, Water Pollution Research Laboratory

THE possibility of recovering useful materials from sewage has been a subject of controversy for many years. It is true that, in aggregate, sewage from a community of any substantial size contains large amounts of organic matter, mostly as solids in suspension, and compounds of nitrogen, phosphorus, and potassium, to a considerable extent in solution, but the difficulty of obtaining anything useful lies in the fact that these materials are present in very low concentrations. It is not always realised that sewage, grossly polluting liquid though it is, consists almost entirely of water—to the extent, in fact, of about 99·8 per cent. In crude sewage the concentration of suspended solids may be perhaps 300 to 400 parts per million (that is 0·03 to 0·04 per cent) and the concentrations of phosphate (as P_2O_5), potash (as K_2O), and total nitrogen (as N) perhaps 10 20, and 60 parts per million respectively. In these circumstances the prospects of obtaining useful materials economically from sewage are severely limited and in practice the only materials that are utilised are water and sludge.

The water in sewage is usually recovered indirectly, in that the purified effluent is in many cases discharged to a fresh water stream. In the stream micro-organisms of the types found in the effluent die out and if the stream is in a satisfactory condition the small residual concentration of organic matter is oxidised by biological agencies, a process often known as "self-purification." In due course the water of the river becomes fit to be withdrawn again for treatment to produce potable water and this indirect re-use of water is an important factor in the water economy of all densely populated and industrialised countries. Sewage might also be used for recharging underground water-bearing formations, but there is a danger of contamination.

A more direct use of sewage effluent and even of settled sewage is for irrigation of agricultural land and this has been practised to some extent in Europe and America.

Under some circumstances discharge of sewage effluent to a river may encourage profuse growths of algae. This effect can be a nuisance and in order to prevent it an attempt on a pilot-plant scale has been reported to remove phosphate from sewage effluent by adsorption on a precipitated floc of aluminium hydroxide. After the floc had been separated and redissolved for re-use the phosphate was recovered as an impure calcium salt which it was claimed could be used as a fertiliser. The process was however too expensive to be practicable. On the other hand, it has been proposed to grow algae on sewage effluent in lagoons and to harvest the material for edible purposes, but this approach has also not been tried on a commercial scale.

Purified sewage effluent, usually after removal of the small amount of suspended solid matter by filtration, can be used directly for industrial cooling water. Some 100 million gallons of sewage effluent are used per day for cooling and process water by the Bethlehem Steel Corporation, at Baltimore in the United States.

Sludge is produced at two stages in the purification of sewage. Suspended solid matter is separated from crude sewage by sedimentation and is withdrawn from the tanks used for this purpose as crude primary sludge, which may contain about 95 per cent water. Biological oxidation of the organic matter in the settled sewage gives rise to secondary sludges—humus sludge from percolating filters and surplus activated sludge from the activated-sludge process. These secondary sludges contain more water than does primary sludge and are more difficult to separate from the water; activated sludge, for example, may contain only about 1 per cent solids. Secondary sludges, particularly activated sludge, are sometimes dealt with separately but in many treatment works they are returned to the inlet to the primary sedimentation tanks to be resettled in admixture with primary sludge.

Disposal of these sludges is a serious problem but there are two main useful outlets for the materials. These are the production of combustible sludge gas by anaerobic digestion and the use of dry or partially dry sludge in agriculture as a fertiliser.

During the Second World War the possibility of extracting grease from ordinary domestic sewage sludge was considered. In an investigation at the Water Pollution Research Laboratory it was found that fresh sewage sludge contained about 16 per cent grease on dry weight, but the value of the extracted material was low, because it contained impurities which would interfere with its use for many purposes.

At a few places, where suitable agricultural land is available close to a sewage-treatment works, controlled application of wet sludge is practised, but in general the sludge has to be dewatered to a handleable consistency before it can be used. The most widely used method is by draining and drying on under-drained beds in the open air, but methods involving chemical conditioning and filtration are also in use. By all these methods the water content is reduced to about 60 to 80 per cent and further drying is usually accomplished by application of heat, which is expensive.

It has been shown, for example by the Rothamsted Experimental Station, that sludge from domestic sewage contains available nitrogen and phosphate and that it is valuable as a fertiliser, though not so good as an equal weight of farmyard manure. According to the report of an informal working party of the Ministry of Housing and Local Government on the Treatment and Disposal of Sewage Sludge, about one-third of the sewage solids produced in England and Wales, or some 350,000 dry tons per annum, was at the time of the report (1954) disposed of on land for manurial purposes. Sludge, like the sewage from which it is derived, contains bacteria and in theory could be a source of transmissible disease. Although there is no evidence in this country of disease having been carried in this way, the normal practice with sludge which has not been subjected to some sterilising treatment, for example heat treatment, is to avoid its application in the case of field crops which are likely to be eaten raw.

Activated sludge contains more available nitrogen than primary sludges and at Milwaukee a heat-dried activated sludge is produced under the name of "Milorganite" which is sold extensively in the United States as a fertiliser. An interesting development is that activated sludge and digested sludge have been found to contain Vitamin B_{12}. It is reported that dried sludge has been fed to animals successfully, and plants for extracting vitamin content have been set up in the USA and Germany.

Composting of sewage sludge with dry organic material, particularly domestic refuse, is frequently advocated as a means of disposing of the sludge and producing a useful manurial material. There are several instances of successful composting plants but the amount of sludge disposed of in this way is small and the product is usually made use of in horticulture. Mechanical composting is treated in an article on a later page.

Anaerobic digestion of sludge is practised at most large sewage-treatment works primarily with the object of reducing the bulk and offensiveness of the crude sludge, but as a by product a considerable quantity of sludge gas containing about 70 per cent methane is produced. This gas is valuable for its heat content and it is usually used on site to provide enough heat and power to run the whole works, making it independent of outside power.

Methane can be used as a basis of chemical synthesis, but the only large scale use of sludge gas in this connection appears to have been in South Africa for the production of cyanide from methane and ammonia during the Second World War.

In special circumstances products of more than usual value can be extracted from a sewage containing industrial wastes. One of the best known instances is at the Esholt works of the City of Bradford, Yorkshire. In this centre of the wool industry, wool-scouring liquors carrying wool grease are discharged to the sewers. On reaching the sewage-treatment works the mixture of sewage and greasy liquors is acidified and the precipitated sludge is heated with further acid and hot pressed to extract the grease.

The material so obtained is then refined and processed in various ways to give a range of valuable products, including lubricating greases, industrial soaps, fatty acids, and special paints. The residual sludge solids from which the grease has been extracted form a useful fertiliser. In the annual report of the City of Bradford Sewage Committee it is stated that sales of grease and specialised products totalled £127,923 during 1958, and in a brochure of the committee issued in 1947 it was stated that income from this source was applied to offset to a considerable extent the cost of treatment of sewage from Bradford. It must be emphasised, however, that this is an exceptional case, and that when it is desired to recover material from an industrial waste it is nearly always better to do so before, and not after discharge to a sewer.

Old Bridge Provides Formwork for New

To avoid erecting scaffolding in the river, the shutter work for the new prestressed concrete bridge at Perth was suspended from the girderwork of an old bridge which was afterwards dismantled.

THE QUEEN'S BRIDGE, now completed for the City and Royal Burgh of Perth, is the most easterly road crossing of the Tay, and as such is an important link in the chain of roads on the east coast of Scotland. It replaces, on the same site, the Victoria bridge, a four-span steel girder through bridge continuous over two of its three river piers. These piers were not sound, and the effects of river scour and traffic vibration made remedial work necessary.

Schemes were prepared for strengthening the bridge, or for replacing it with a four-span reinforced concrete arch bridge or a three-span prestressed concrete bridge; the scheme for a prestressed bridge was selected.

The new structure, which is 400 ft long, is on the line of the old bridge and is supported by two river piers near two of the original piers, the new piers being founded on precast concrete piles. The new bridge consists of four longitudinal beams, with transverse slabs top and bottom, forming three hollow boxes side by side; it is prestressed on the Freyssinet system and is continuous over its three spans. A reinforced concrete edge beam along each side of the roadway supports a footpath; the space between the edge beams and the main prestressed structure is used as a services duct.

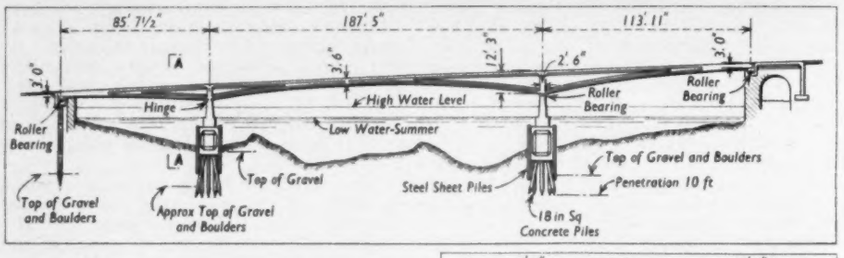
Because the Tay at Perth is tidal and subject to rapid rises in level, it was decided to construct the new bridge without any scaffolding in the river. The road deck of the old bridge was stripped, leaving only the main longitudinal beams, and the transverse beams which occur at 12 ft centres. This skeleton framework was then jacked up approximately 6 ft on the existing piers, so that the transverse beams just cleared the road line of the new bridge. All formwork for the new bridge was then supported from the old bridge by a system of hanger rods, prefabricated plywood formwork panels being suspended from the existing transverse girders.

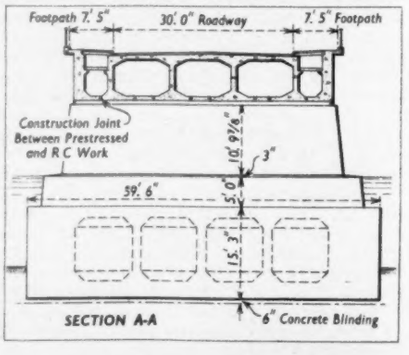
Work began at the two river piers simultaneously, and was carried outwards from the piers in both directions, so as to keep each section approximately in balance around its pier at all times. The prestressing cables are arranged in layers over the supports, with end anchorages at intermediate construction joints or pockets in top and bottom flanges, so that each section could be stressed and made self supporting as it was constructed. The final closure was at the crown of the centre span. Continuity is effected by a number of cables running the full length of the bridge, supplemented by comparatively short cables at the top and bottom in the centre portion of the middle span.

After the prestressed roadway section had been completed, the transverse beams of the old bridge were jacked up off the new road slab, and the old longitudinal girders and their supporting river piers removed. This permitted the reinforced concrete edge beams, which lie along the line of the old longitudinal beams, to be built, the formwork being supported from the transverse girders of the old bridge.

The final stages in the construction were the completion of the service ducts, removal of the old transverse beams, surfacing the roadway, and laying the footpath paving slabs.

The bridge was opened to traffic after 15 months, but finishing work and painting of the railings took a further six weeks to complete. It cost approximately £150,000. The consulting engineers for the work were F. A. Macdonald and Partners and the contractors, Whatlings Limited, both of Glasgow C3.



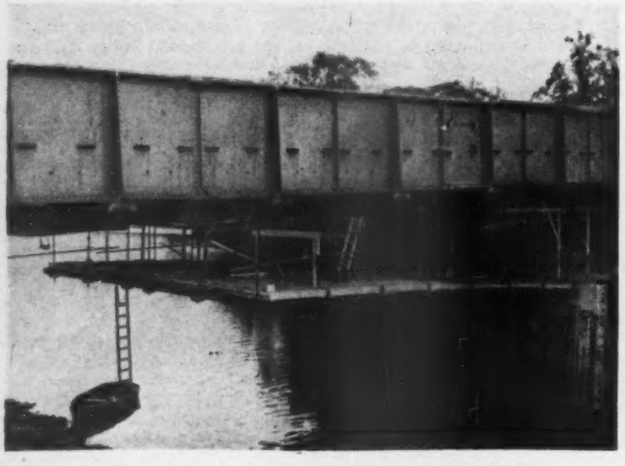


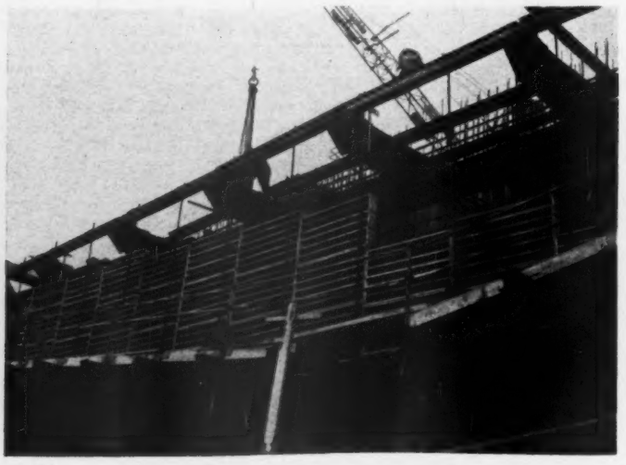
(*Above*) *The new Queen's Bridge at Perth. It replaces an existing four-span through girder steel bridge.*

(*Right*) *An enlarged section through the pier and the full-depth superstructure, showing the hollow box construction of the bridge.*

Below left) *Hanging the soffit shuttering from the girders of the old bridge.*

(*Below right*) *Shutterwork in position for a full-depth pour above one of the new piers.*

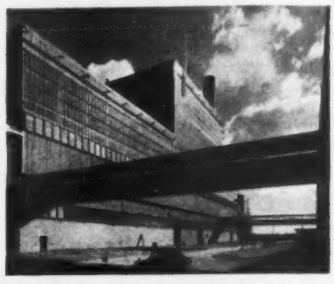




Land Reclaimed with Power Station Ash

When Kincardine power station, belonging to the South of Scotland Electricity Board, is finally completed by the addition of two 200 MW turbo-alternator sets to the three 120 MW sets now operating, up to 200 tons of furnace ash and 1,300 tons of fly ash will be handled daily.

The fly ash is carried by compressed air from the back of the boilers to bunkers where it is mixed with sea water drawn off from the circulating water system. The slurry is kept at a concentration of 3½ lb of ash to a gallon of water. From the bunkers three disposal pumps (each able to handle 2,030 gallons of slurry per minute) drive the slurry through two asbestos cement pipes to Longannet, three miles downstream. There a disposal site has been constructed and an area of 280 acres will one day be reclaimed from the River Forth and made available for agriculture.



Kincardine power station is sited on reclaimed land and the fly ash produced is used for further reclamation work.

Enclosing the site is a river embankment 9,000 ft long, comprising a filling of sandstone, taken from a nearby quarry, and backed with colliery waste. The outer face of the embankment is protected with winstone pitching and incorporates a wave deflector wall. The landward embankment, forming the north side enclosure, is built wholly of colliery waste.

The station itself is also situated on a site that at one time formed part of the foreshore of the River Forth. In 1822 an area of 150 acres was enclosed and reclaimed from the river. As an additional security against flooding, the embankment has been raised and strengthened.

Timber Shells Simplified

Work has begun on building a laboratory at the Timber Development Association's research station at Tylers Green specially for testing shells, plates and space frames. The test floor will be 50 ft square and will be 14 ft high to the eaves; beyond this area there will be a group of humidity control chambers and above them a gallery to accommodate the remote measuring instruments. A single storey projection to the main block will contain the offices.

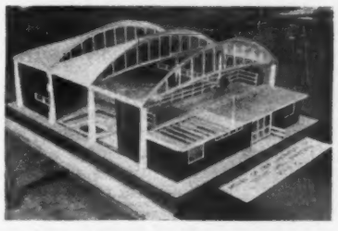
The roof over the test area will be three conoid shells spanning between glued laminated tied arches and shaped edge beams. Support for the roof is to be eight box columns tapered to the underside of the edge beams and arches at a height of 14 ft. The rise of the arches above the eaves will be 10 ft and the ties will also rise slightly to give additional stiffness to the shells. At the rear of the building, remote from the office extension, there will be a 50 ft span built-up I section beam, its upper flanged curved to match the rise of the ties to the arches; the web of the girder will be two layers of boarding laid diagonally, nailed and glued. Each sheet will be of three layers of ¾ in tongue and groove boards, fixed with ring shanked nails—something of an innovation in this country. A wood-wool slab 4 in thick will provide thermal insulation and a pvc sheeting, silvered on the top side, will give weatherproofing.

For the walls, which will be non-load bearing except as they prevent end-to-end sway, will comprise an outer cladding of solid tongue and groove boarding mounted on frames, lined with plywood and filled with foam polystyrene.

Canadian timbers are being used throughout. The main arches, ties and edge beams, already laminated at Tylers Green, are of 1½ in Western hemlock. Western red cedar will be used for roof shells and outside cladding and it is hoped to line the building with Canadian Douglas fir plywood. The columns will be of Douglas fir timber and plywood. A grant from the British Columbia Lumber Manufacturers' has made possible this new laboratory and the opportunity to experiment with timbers which have not previously been used for shell construction.

Reinforced concrete has been used for the floor and a grid of threaded sockets at 2 ft centres has been built in to provide anchor points for a flexible loading system. By arranging for the loading to be from the underside, the top of the models under test will be free for fixing strain gauges, deflection scales and other observation equipment.

It is hoped that when the laboratory is available, research will be extended to study a variety of shapes and support conditions for timber shells, folded plates and skeletal space frames.



Model of the new TDA shell laboratory at Tylers Green.

Now that the mathematical analysis of shells has become so advanced—and there is the experience of well over 50 timber shells in this country—attempts will be made to devise a straightforward design technique suitable for general office use. The problems of prefabrication, which has received little attention in this country so far, will also be examined. One topic that urgently requires investigation, especially as it affects hyperbolic paraboloids and the other extreme forms possible in timber, but which cannot be undertaken at Tylers Green, is that of wind loading, for such experience as does exist shows that very severe loads can be imposed by the low pressure pockets created in the curves of the roof.

Adhesive Limitations in Glulams

The future of glued laminated members lies with large span beams and arches. The operational time of the adhesives is so short that the labour and time required to set up and dismantle the clamping system used in their manufacture is excessive, and work in the TDA's glued structures laboratory is being concentrated on finding methods better than the conventional screwed clamps. Hydraulic systems are being tried and, in addition to speedier working, it is hoped that a more uniform clamping action will be obtained, giving glue lines of equal thickness both along and through the members.

A novel method of curing end joints using cheap low voltage equipment, instead of expensive equipment now employed, has been successful and further work planned.

Measurements taken during the manufacture of the three 50 ft span arches for the new shell laboratory (described in the previous note) showed that "spring back" after release from the clamps was very consistent.

Also in hand is an investigation to see that the adhesives are capable of carrying design loads for the economic life of the structure. The relevant British Standards are based principally on the testing methods and techniques of the plywood industry and the present work is aimed at seeing if the tests are adequate for the needs of the glulam industry. The work at the laboratory suggests that much more rigorous testing methods are required by the structural industry, including some new tests to examine fatigue of glue lines.

As a better understanding of the grading of timber is obtained—and appreciated by the trade—so it will become possible to make better use of low quality woods which previously would have been rejected as waste. Such poor timber may safely be employed in structural members if it is used in low stressed regions.

150 ft RC Beams in Railway Warehouse

The new railway Continental freight depot at Hither Green, London, SE, which comes into operation during October, has been completed six months ahead of schedule by Taylor Woodrow Construction Limited, for Southern Region of British Railways. The depot, part of British Railways modernisation scheme, will now be well in time for the seasonal trade in foodstuffs and goods, including the Christmas traffic.

Taylor Woodrow carried out the construction of the reinforced concrete framed main building, 1,000 ft by 150 ft, and were also responsible for its design; above two-thirds of the main building is a second storey, with structural steel roof trusses, for warehousing and administration.

The roof of the Southern Region's Continental freight depot near London.

The contract included ancillary buildings and the laying of some 3,000 yards of siding.

Work started on the site, once allotments, at the end of March, 1959, the first task being to excavate about 120,000 cu. yd of earth by dragline and tractor shovel and then place over 115,000 cu. yd of fill to depths of up to 20 ft. At one time the contractors were removing excavated material at the rate of 3,800 cu. yd daily.

The frame of the main buildings consists of 31 beams supported on reinforced concrete columns. Each beam has two spans of 85 ft and 65 ft, being 7 ft deep and 5 ft deep in each span respectively, and contains 22 tons of steel. They were cast *in situ* in five months on false work—designed and erected on site—using travelling gantries. The all-up weight of the beam, shuttering and gantries was 2 tons per ft run. Concrete was placed by a 22 RB using roll-over skips in conjunction with dumpers modified to accommodate the skips; the concrete came from two Benford 18/12 reversible drum mixers, fed by portasilo.

Nuclear Graveyards

WASTE DISPOSAL of irradiated materials presents atomic energy authorities with a major problem which is not easily solved. No final answer is yet in sight, and more time and money might usefully be spent in seeking one. The great variety of materials involved adds to the difficulty, and each new situation presents its own peculiar hazards. Strict control of nuclear wastes is vital for the well being of mankind, since any undue release of radioactive substance may lead to dangerous contamination of the environment.

French Seek Safe Deposit

The news last week that the French government intended to dispose of 6,500 drums of radioactive waste into the sea between the South of France and Corsica has brought out the complexity of the problem. In spite of agreement by the Commissariat à l'Energie Atomique and Euratom that there would be no danger, the protests from the mayors of local towns and certain oceanographers have caused the government to postpone the experiment "for at least a month." On Sunday, Monsieur F. Perrin, the French High Commissioner for Atomic Energy disclosed that atomic waste from the Saclay laboratory had for five or six years been dumped in local rivers without any ill effects. This disclosure is an effort to reassure the nation that the hazard from dumping in the Mediterranean will be negligible.

Basic Considerations

Three fundamental considerations are involved:

(1) the specific nature (physical, chemical, and radioactive concentration) and the quantity of radioactive waste material to be discarded;

(2) the characteristics (physical, chemical, and biological) of the receiving environment; and

(3) the basic radiation protection standards or other limiting criteria established by law.

The method of disposal is governed by the radioactive concentration. The potential hazard of the irradiated material is a function of (*a*) the total quantity of radioactivity; (*b*) the relative toxicity of the material, which is related to its isotropic composition and the maximum allowable concentration in air and water; and (*c*) the dispersion of the material, which is related to its physical and, in some cases, chemical state. This semi-quantitative description omits the factor of environment which often has considerable influence.

Dilute or Concentrate

The two basic approaches to radioactive effluent control have been characterised by the two phrases "dilute and disperse" and "concentrate and contain." The first can be applied to the low-hazard potential waste, for example, the cooling water from the pond in which irradiated fuel elements are often placed before chemical processing. The second is applied to high-hazard wastes, which come, for example, from the fuel cans or sheaths removed in the first stage of processing irradiated fuel elements. The separated canning material has no future use and forms a highly active solid waste. It is essential that before disposal a detailed quantitative examination is made of the waste material and the specific environment, and of the interaction between the two. In this way it may be judged whether the generally acceptable radiation standards can be met.

Principles of Waste Management

In establishing waste management and radiation protection criteria, three basic principles should apply:

(1) The minimum practicable amount of radioactive material should be dispersed into the environment.

(2) Continual or periodic monitoring is vital to keep within the radiation standards.

(3) Performance criteria must be modified to suit any changes that may occur in the environment or waste materials.

Seven Methods of Disposal

The great variation in the characteristics of waste from various processes, including the material's half life, chemical state and concentration, may mean that for each problem a different waste handling method is required. Several methods of disposal have been used: (1) storage, (2) chemical precipitation, (3) evaporation, (4) ion exchange, (5) neutralisation, (6) crystallisation, and (7) fixation in an inert solid. The expense of storing or dumping the waste material makes it necessary to reduce the volume to the smallest possible, and several of the methods mentioned in the table above are used to concentrate the waste. Chemical precipitation is employed to separate the bulk diluents of aqueous wastes, and it may also be used in conjunction with ion-exchange processes, which are usually employed for high-level waste treatment. Neutralisation is normally applied to acidic wastes to reduce corrosion, and it is often followed by one of the other methods to concentrate the waste.

Sea Disposal

Highly radioactive wastes are often disposed of by placing the material in concrete containers, or in the case of lower-activity materials, in drums, which are then dumped in the sea.

This method is not entirely satisfactory because little is known of the extent to which ocean currents may spread the activity and hence of the degree to which it will affect marine and biological life. Recently work has been carried out in the area of Windscale using large quantities of dye to investigate the currents. The rate of spread and the rate of dilution were studied. It was found that there was complete vertical mixing and certain conclusions were drawn as to the surface currents. Usually the disposal ground for the drums is well out to sea and the regulation states that the drums must retain their integrity until they have reached 1,000 fathoms. An estimate of the radioactive accumulation in 1965 is 10,000 million curies rising to 1,500,000 million in the year 2000. The expense of dumping at sea for a quantity of this size would be prohibitive, and other methods are being developed, since reactor operators wish to reduce any expense at this last stage in the reactor cycle to a minimum. For the disposal of low-activity liquids pipelines may be run into the sea or rivers, since it is found that the radiation increase with respect to the background level is in all cases negligible or only slight. At Winfrith Heath, for example, a pipe passes two miles out to sea along the sea bed in order to dispose of active effluent.

Storage Tanks

Some 65,000,000 gallons of radioactive liquid waste is at present stored in the United States. The advantages of this system are that the wastes may be reprocessed at any future date and it is a controlled system. However, there is the problem of space and the possibility of having too much in one area.

Ground Dispersal

Much consideration has recently been given to a method whereby wastes are deposited in deep wells in the earth's crust. The local geological structure has to be examined carefully, since it is necessary for the waste to remain in the well and not seep into subterranean channels through which they may eventually come into contact with the surface and human beings. For example, old salt mines or coal mines have been considered for this purpose and also geological faults which would entrap the waste material.

Liquid into Solid

The United States Atomic Energy Commission are developing two processes. One involves the conversion of the radioactive liquid into a solid oxide by heating in a liquid-solid contactor. The other incorporates the radioactive material either physically or chemically in clays, glasses or synthesised crystal material such as feldspars or micas, but more research on these substances is necessary. At the Idaho Chemical Processing Plant engineering development work is in progress on a fluidised-bed technique, which is being used to convert liquid wastes into a solid oxide at the rate of 60 gallons per hour. In these methods the formation of a gas in the enclosure may be a problem.

Statutory Control

Strict control is placed on the deposition of any radioactive waste by atomic energy authorities. In the United Kingdom no disposal of radioactive waste is permitted without the authorisation of the Ministry chiefly concerned. The USAEC adopt similar rules and in the case of dumping at sea there are 12 recognised and approved areas.

Notes and News

Separation by Centrifuge

The disclosure that Germany has made further advances in the development of a gas centrifuge for separating uranium 235 from uranium 238, and that she has sold two to Brazil, and one to the United States, has brought much hue and cry. It is suggested that the smaller countries will now be able to afford the manufacture of nuclear bombs. Equally important is the impetus that this development might give to small power reactors, the economy of which depends on cheap enriched fuel. Germany has been conducting research into the possibilities of separating uranium by the centrifuge method for several years. (Atomic Review, 21 July '57.)

Process in Outline

The gas mixture of uranium hexafloride is passed into a rapidly rotating cylinder or centrifuge, the force on the heavier component of the mixture causes it to concentrate near the cylinder walls and the lighter component near the cylinder axis. Currents of vapour may then be introduced to remove the heavier isotope which has collected at the periphery of the centrifuge. Another stream is introduced to remove the lighter isotope that has collected along the central axis. If the centrifuge is placed vertically the heavier isotope will gather at the bottom of the container, and the lighter one at the top, which facilitates collection.

Development Background

The work on the centrifuge is being carried out by the German company Degussa under Dr. Gernot Zippe who also built a similar machine for the Russians during his internment. A limitation that has severely limited the development of this machine is that materials to withstand the conditions involved have not been available at the high speeds required for efficient operation. The production of enriched uranium by this method requires approximately one tenth of the electricity consumed in the present diffusion process, but the capital costs at the present stage of development will be higher, thus off-setting much of the gain. It is also known that the United States, Holland and the United Kingdom are engaged in similar work.

Production Costs

Dr. Zippe has indicated that the cost of enriched uranium production by the centrifuge method would be $300, whereas by the diffusion process it is $135. A separation plant using eight 7·2 in diameter and 47 in high centrifuges revolving at 32,000 r.p.m. has been described as one possible way of treating the process.

The

'Engineering' Appointments

Section

CENTRAL ELECTRICITY GENERATING BOARD

Southern, South Western and South Wales Region

RESEARCH AND DEVELOPMENT DEPARTMENT

PORTISHEAD, BRISTOL

Applications are invited for the following posts based at new laboratories which have recently been set up at Portishead, ten miles west of Bristol.

MECHANICAL ENGINEERS (4 Posts). Vacancy No. 83.

Engineers with a strong interest in stress or heat engineering are required for investigations which include: vibrational stress in turbine blades; thermal stress in turbine casings and pipe flanges; thermal insulation problems; utilisation of waste steam and the drying of wet coals.

Applicants should possess an honours degree in mechanical engineering, should have had several years' experience in a responsible position in an allied field and preferably have served a recognised graduate apprenticeship. Some knowledge of electronics would be an advantage for two of the posts.

The salaries for these posts will be within the ranges:

£1005 to £1720 (Grades 9-5)

For all these posts there is a contributory pension scheme and opportunity for promotion within the Board's Research and Development Departments. Assistance may, under certain conditions, be given with housing.

Applications on Form AE6/ACT obtainable from the Regional Secretary:—

CENTRAL ELECTRICITY GENERATING BOARD

Southern, South Western and South Wales Region

1, Eaton Crescent, Clifton, BRISTOL, 8

should be returned to him by Monday, 7th November, 1960. D 174

PUBLIC APPOINTMENTS

GENERAL FITTER

MINISTRY OF LABOUR require GENERAL FITTER for appointment as Instructor (unestab.) at GOVERNMENT TRAINING CENTRE, LETCHWORTH, HERTS. Applicants must be British subjects who are experienced and fully skilled, able to teach their trade, and supervise the work, and maintain control of the trainees in their trade. They should have undergone training usual in their trade followed by at least 5 years practical experience, and should preferably possess O.N.C. or C. & G. Certificate or equiv. quals., where appropriate. Prospect of eventual establishment. Commencing salary (at age 30 and over) £930 rising by two annual increments to £1000 p.a.—Write for application form within 7 days to EMPLOYMENT EXCHANGE, LETCHWORTH, HERTS. Selected applicants will be required to pass a Theoretical Test before appointment and a Practical Test of normal trade skills after taking up appointment. D 202

BRADFORD INSTITUTE OF TECHNOLOGY

Applications are invited for the following posts:—

READER IN MECHANICAL ENGINEERING

Candidates should possess the qualifications and experience to direct research and post-graduate work and to take a leading part in advanced teaching. Importance will be attached to industrial and research experience. Adequate facilities will be given to undertake research and suitable technical assistance and equipment are available.

Salary: £1800-£2100 per annum (or above in special cases).

PRINCIPAL LECTURER IN MECHANICAL ENGINEERING

Candidates should be qualified to teach to final degree and Diploma in Technology standard and should have adequate research and industrial experience. The successful candidate will be expected to assist the Head of the Department with the organisation and administrative work of the Department and will be encouraged to develop industrial contacts.

Salary: £1750 to £1900 per annum.

Previous industrial or research experience at a suitable level will be taken into account in fixing the commencing salary.

Senior members of staff are encouraged to undertake consultant work in industry and may retain fees paid for such work.

Further particulars and forms of application may be obtained from the REGISTRAR, BRADFORD INSTITUTE OF TECHNOLOGY, BRADFORD, 7.

HENRY PATTEN,
CLERK TO THE GOVERNORS D 191

HUDDERSFIELD COLLEGE OF TECHNOLOGY

Principal: Dr. W. E. SCOTT, M.B.E.

DEPARTMENT OF CIVIL AND MECHANICAL ENGINEERING

Required as soon as possible:—

(1) SENIOR LECTURER to supervise project work carried out by full-time Sandwich Course students. The candidate, who should possess an Engineering Degree, or equivalent, should have had research, industrial and preferably teaching experience and should indicate the Mechanical Engineering subjects which he would be prepared to teach up to Graduate level.

(2) GRADE B ASSISTANT to teach Mechanical Engineering subjects.

Salary (Burham Scale):

SENIOR LECTURER: £1550 p.a. by £50 p.a. to £1750 p.a. The commencing salary will depend upon previous experience.

GRADE B: £700 p.a. by £27 10s. p.a. to £1150 p.a. There are additions for approved qualifications and training and the commencing salary may include increments for approved industrial experience.

Forms of application and further particulars obtainable from the Principal, to whom applications should be returned without delay.

H. GRAY,
CLERK TO THE GOVERNORS. D 209

BRISTOL COLLEGE OF SCIENCE AND TECHNOLOGY

(A COLLEGE OF ADVANCED TECHNOLOGY)

ASHLEY DOWN, BRISTOL 7

Principal: G. H. MOORE, M.Sc., F.P.S., F.R.I.C.

DEPARTMENT OF AERONAUTICAL AND MECHANICAL ENGINEERING

The Governors invite applications for post of SENIOR LECTURER or LECTURER in STRUCTURAL ENGINEERING. Duties will include teaching Aeronautical and Mechanical Engineering Students on Diploma in Technology and Higher National Diploma courses.

Applicants should have an honours degree or equivalent qualifications, and industrial and/or research experience. Research and consulting work is encouraged.

Salary: Senior Lecturer within range £1550 to £1750 p.a. Lecturer within range £1370 to £1550 p.a.

Details and application forms, to be returned within two weeks, from the REGISTRAR. D 208

HSBT

have the following vacancies:—

1. 1 SENIOR INSTALLATION DRAUGHTSMAN

Applicants should have a minimum of seven years' experience in a Drawing Office, on the installation of land turbine or diesel plant, and be capable of initiating schemes for foundations, boiler plant, installation of auxiliaries and piping services. H.N.C. is desirable.

2. 2 INSTALLATION DRAUGHTSMEN

Applicants should have a minimum of four years' Drawing Office experience in the layout and detailing of turbine or diesel plant in power stations or ships. Duties would include the preparation of tender drawings and the detailing of auxiliary services. Minimum qualification O.N.C.

Interested applicants should write in the first instance stating age, experience and qualifications and salary required to:—

The Personnel Manager,

HAWKER SIDDELEY BRUSH TURBINES LIMITED,

Hucclecote, Gloucester.

D 138

GRADUATE ENGINEERS

A very large British company concentrating on design and development as well as on production in this country and abroad, requires additional Graduate Engineers due to expansion. The work is varied and interesting and covers a very wide range. Current vacancies provide splendid opportunities for able and ambitious men to join a first-rate company where qualities of initiative are highly regarded. In addition to technical qualifications, particular attention is paid to personality and potential managerial ability. Excellent training facilities are available to enable men of the right quality to advance high in the Company's service.

There are vacancies in design, development, construction, electrical work, instrumentation, estimating, Works Engineering, and Engineering Services.

Applications will be considered from those who have recently graduated, or have completed a post-graduate apprenticeship, or from those graduates who have already had a few years' experience in industry. Age limit 22/30. Starting salaries up to £1500 will be paid, according to age, experience and qualifications. The company assists married men with removal.

The Company is seeking men of ability and promise and only those who are confident that they have the necessary qualities should apply. *Reference Number* 116.

Please reply in confidence quoting Reference Number to:—

Robert Clive (Consultants) Limited

27, ALBEMARLE STREET, LONDON, W.1.

D 169

METALS DIVISION

ICI

A SENIOR INSTRUMENT DEVELOPMENT ENGINEER

is required for the INSTRUMENT DEVELOPMENT SECTION of the DIVISION ENGINEERING DEPARTMENT at WITTON, near BIRMINGHAM.

His main responsibilities will be primarily concerned with non-destructive testing work, and the progress of plant instrumentation over a wide field, respectively.

Candidates, preferably in the age range 30/40, with an Honours Degree in Physics or, possibly, light Electrical Engineering, should have some experience of development work. A good knowledge of the light electrical field of automatic control or non-destructive testing of materials is essential, and some experience of the general field of industrial instrumentation is desirable.

There is a good starting salary with excellent prospects of advancement. The appointment is pensionable and there is a profit-sharing scheme in operation. Assistance can be given to a married man towards house purchase and removal expenses.

Please write for an application form to the—

Assistant Personnel Manager (Staff),

IMPERIAL CHEMICAL INDUSTRIES LIMITED,

Metals Division, P.O. Box 216, Kynoch Works, Witton, Birmingham, 6.

quoting ENG/452/ENG. D 217

SOUTH EAST METROPOLITAN REGIONAL HOSPITAL BOARD

Applications invited for the following posts:—
(*a*) ENGINEERING DRAUGHTSMAN (Electrical).
(*b*) ENGINEERING DRAUGHTSMAN (Heating and Ventilating).

Salary within the range of £570-£1300 according to experience and qualifications. Preference will be given to candidates who hold the Higher National Certificate or Sections A and B of the Institution of Heating and Ventilating Engineers (or equivalent) and have had suitable practical and theoretical training including site or workshop experience. Consideration will be given to experience as alternative to qualifications.

Applications stating age, qualifications, experience and present salary, with names of three referees should reach the SECRETARY, 40, EASTBOURNE TERRACE, W.2, by 7th NOVEMBER. D 213

JUNIOR DRAUGHTSMAN

JUNIOR DRAUGHTSMAN, Croydon. Applicants should have reached G.C.E. standard and have had general engineering training; some workshop practice an advantage. Salary age 18-20, £355-£425 per annum, according to age, age 21 and over within ranges £480-£685 per annum, according to qualifications and experience.—Applications in writing, quoting reference V15/1337 and giving full details should be sent to the PERSONNEL MANAGER, SOUTH EASTERN GAS BOARD, KATHARINE STREET, CROYDON, WITHIN SEVEN DAYS. D 204

MIDDLESEX COUNTY COUNCIL
EDUCATION COMMITTEE
ENFIELD TECHNICAL COLLEGE, QUEENSWAY, ENFIELD, MIDDX.

Principal: RODERICK McCRAE, B.Sc. (Eng.), M.I.Mech.E.

DEPARTMENT OF PRODUCTION ENGINEERING AND MANAGEMENT

Required for 1st January, 1960:
SENIOR LECTURER IN MANAGEMENT STUDIES to teach Management subjects to B.I.M. Diploma standard. Applicants must be University Graduates and be capable of taking responsibility for the development of Management Courses in the Department.

Candidates should have had teaching experience and should have held responsible managerial posts in industry.

Salary within the range: £1588-£1801 per annum.

Application forms (foolscap s.a.e.) from the Principal, to whom completed forms should be returned within 14 days of the appearance of this advertisement.

C. E. GURR, M.Sc., Ph.D.,
CHIEF EDUCATION OFFICER. D 190

ENGINEER

MINISTRY OF LABOUR require ENGINEER for appointment as a Draughtsman Assessment Course Instructor (Unestab.) at GOVERNMENT TRAINING CENTRE, SLOUGH, BUCKS. Applicants must be British subjects with a wide experience in the operation of machine tools and who possess good general fitting knowledge. They must be fully skilled, able to teach their trade, and supervise the work and maintain control of trainees in their trade. They should have undergone training usual in their trade followed by at least 5 years practical experience, and preferably possess O.N.C. or C. & G. Certificate or equiv. quals. where appropriate. Prospect of eventual establishment. Commencing salary (at age 30 and over) £930 rising by two annual increments to £1000 p.a.—Write for application form within 7 days to EMPLOYMENT EXCHANGE, SLOUGH, BUCKS. D 201

MINISTRY OF LABOUR

MINISTRY OF LABOUR require MILLING MACHINE OPERATOR for appointment as Instructor (unestablished) at GOVERNMENT TRAINING CENTRE, LETCHWORTH, HERTS. Applicants must be British subjects who are experienced and fully skilled, able to teach their trade, able to supervise the work and maintain control of trainees engaged in their trade. They should have undergone training usual in their trade followed by at least 5 years practical experience, and should preferably possess O.N.C. or C. & G. Certificate or equiv. quals. where appropriate. An experimental toolroom miller is likely to prove suitable. Prospect of eventual establishment. Selected applicants will be required to pass a Theoretical test before appointment and a Practical Test of normal trade skills after taking up appointment. Commencing salary (at age 30 and over) £930 rising by two annual increments to £1000 p.a.—Write for application form within seven days to EMPLOYMENT EXCHANGE, LETCHWORTH, HERTS. D 203

GOVERNMENT OF SIERRA LEONE
TELECOMMUNICATIONS ENGINEER
POSTS AND TELECOMMUNICATIONS DEPARTMENT

Responsible for supervising, maintaining, installing and developing telecommunications services generally including Carrier Telephony under the direction of the Postmaster-General and the Engineer-in-Chief.

Contract appointment. Salary range £1470-£2145 a year. Gratuity 15 per cent. of salary. Free passages. Rented quarters. Children's allowances. Generous leave. Candidates under 45 years should be either A.M.I.E.E. or hold a Degree or Diploma in Electrical Engineering with Telecommunications subjects. They must have a sound knowledge of theory and practical experience of telecommunications engineering generally.

Write DIRECTOR OF RECRUITMENT, COLONIAL OFFICE, LONDON, S.W.1, giving full names, age, qualifications and experience quoting BCD 108/15/03./D5. D 211

UNIVERSITY OF QUEENSLAND
SENIOR LECTURER IN ENGINEERING

Applications are invited for the above-mentioned position in the UNIVERSITY COLLEGE OF TOWNSVILLE. Applicants should have a degree with honours in Engineering and should preferably have teaching experience.

Salary £A2520/£A2870.

The successful applicant will enjoy the privileges of superannuation, study leave, travel grants and other benefits available to the academic staff.

Further particulars and application forms are obtainable from the SECRETARY, ASSOCIATION OF UNIVERSITIES OF THE BRITISH COMMONWEALTH, 35, GORDON SQUARE, LONDON, W.C.1.

Applications close, in Australia and London, on 19th NOVEMBER, 1960. D 222

THE UNITED LIVERPOOL HOSPITALS
ENGINEERING ASSISTANT

Applications are invited for the post of ENGINEERING ASSISTANT to assist the Superintendent Engineer. The duties will include the preparation of drawings and specifications. Candidates should be competent draughtsmen and experienced in heating and ventilating and general engineering work and should hold the Higher National Certificate in Mechanical Engineering or its equivalent. The salary is on the scale £600 by £25 (6) by £30 (3) to £840 per annum and a candidate with suitable experience may enter the scale above the minimum. The Terms and Conditions of Service are those of the appropriate Whitley Council.

Apply stating age, qualifications, experience and the names and addresses of three persons to whom reference may be made to the SECRETARY, THE UNITED LIVERPOOL HOSPITALS, 80, RODNEY STREET, LIVERPOOL, 1, by the 8th NOVEMBER, 1960. D 221

MIDDLESEX COUNTY COUNCIL
EDUCATION COMMITTEE
HENDON TECHNICAL COLLEGE

The Burroughs, Hendon, London, N.W.4

Principal: Dr. E. WILLIAMS, B.Sc., F.R.I.C.

This College, situated in pleasing surroundings only a few miles from the centre of London, is one with well-developed advanced courses. "Sandwich" courses are a feature of the college work. An increasing number of men and women of ability and initiative are required as members of the full-time staff and they are offered salaries as shown below.

ELECTRICAL ENGINEERING DEPARTMENT

On January 1st, 1961, there will be a vacancy for an ASSISTANT LECTURER GRADE B to teach Mathematics to engineering students.

The salary for this post is on the scale £738-£1201 per annum plus Graduate and Training Allowances (slightly less for women pending completion of equal pay provision in April, 1961).

Anyone interested in the above post can obtain application forms and more information from the CLERK TO THE GOVERNING BODY, TOWN HALL, HENDON, LONDON, N.W.4.

C. E. GURR, M.Sc., Ph.D.
CHIEF EDUCATION OFFICER. D 216

SENIOR TECHNICIAN

ELECTRONICS. SENIOR TECHNICIAN required for interesting and varied construction and service of a wide range of research equipment. Salary, according to experience, in range £640 to £740 p.a., plus £45 p.a. London Weighting. Qualification supplement if applicable of £50 p.a. Superannuation scheme.—Apply in writing, stating age, present salary and previous experience to PROFESSOR UBBELOHDE, F.R.S., DEPARTMENT OF CHEMICAL ENGINEERING AND CHEMICAL TECHNOLOGY, IMPERIAL COLLEGE OF SCIENCE AND TECHNOLOGY, LONDON, S.W.7. D 215

ST. STEPHEN'S HOSPITAL,

FULHAM ROAD, CHELSEA, S.W.10

(469 beds)

ASSISTANT ENGINEER

Applications are invited for the above vacancy. Salary scale £570 to £700 per annum plus London Weighting £30. Practical training in mechanical engineering essential and experience required of engineering maintenance in charge of craftsmen and operatives. Candidates should possess or be studying for one of the recognised technical qualifications in Mechanical Engineering or Electrical Engineering, or hold a second class Marine Engineers certificate. Application forms obtainable from THE GROUP SECRETARY. D 180

APPOINTMENTS OPEN

DETAILERS

F. R. BULLEN & PARTNERS, CONSULTING ENGINEERS, require for their Glasgow and Darlington offices detailers experienced in reinforced concrete or structural steelwork.—Applications in writing should be sent in the first instance to DACRE HOUSE, DEAN FARRAR STREET, WESTMINSTER, LONDON, S.W.1. D 116

CONVEYOR DESIGN

SENIOR DESIGN DRAUGHTSMAN with extensive experience in all types of Conveyor required for a new factory near Bombay. 3 years' contract with passages paid for family and free furnished accommodation. Salary up to £2500 per annum depending on experience.

Apply BOX D 158, Offices of ENGINEERING.

FOUNDRY SUPERINTENDENT

required for small ferrous and non-ferrous foundry at a Gold Mine in Ghana. This is a jobbing foundry with a current production of only 20 tons per month and it is desired to increase the production and effect improvements to produce better quality castings. Applicants should be qualified to L.I. Metallurgy or hold H.N.C. in Metallurgy with at least 5 years' shop floor experience.

Starting salary around £1500 p.a. but depending on qualifications and experience.

15 month foreign tours followed by 3 months' paid leave. Continuous contract. Passages for applicant and wife and housing provided. Pension Scheme.—Write to BOX D 193, Offices of ENGINEERING.

MANAGER

required for the ENGINEERING WORKS OF MITCHELL COTTS & CO. (LIBYA) LTD., IN TRIPOLI, engaged in steel fabrication, machining, fitting and assembly, with 160 employees. Age over 30 years, commencing salary up to £2800 p.a. (amending the figure in our earlier advertisement), with furnished accommodation and non-contributory pension scheme. Regular home leave on full pay. Previous overseas experience and ability to speak some Italian advantageous. This post offers an interesting opportunity in an expanding business to an engineer with the necessary experience and initiative.

Applications to:—
PERSONNEL OFFICER,
MITCHELL COTTS GROUP, LTD.,
COTTS HOUSE, CAMOMILE STREET,
LONDON, E.C.3. D 173

ENGINEER SURVEYORS

ENGINEER SURVEYORS for inspection of Boiler and Pressure Plant required. Applicants must not be more than 38 years and must have 1st Class M.O.T. certificate with steam endorsement or equivalent qualifications. Salary (ESA Scale) starting at £800 p.a. Other benefits. Areas: Oxford, Reading, Windsor.—Apply ENG. DEPT., GENERAL ACCIDENT ASSURANCE CORP., LTD., 99, ALDWYCH, W.C.2. D 195

ENGINEER

WESTERHAM PRESS LTD. have an interesting vacancy for a young ENGINEER frustrated by lack of opportunity and seeking a position calling for imagination and drive.

Applicants must have good basic knowledge of all printing processes and plant, and should be interested in electronics and coming developments in printing.

Flat available.

Apply: WORKS MANAGER, THE WESTERHAM PRESS LTD., HIGH STREET, WESTERHAM, KENT. D 219

INSPECTION ELECTRICAL ENGINEER

INSPECTION ELECTRICAL ENGINEER required for Manchester Area. Applicants should be between 25 and 40 years of age with minimum qualification O.N.C. and with some inspection experience.—Reply to BOX D 198, Offices of ENGINEERING, giving essential data and salary required.

ENGINEER SURVEYORS

ENGINEER SURVEYORS for inspection of Cranes and Lifting Plant required. Must have drawing office experience of design of Cranes also National Certificate Mechanical Engineering. Essex and Liverpool areas. Permanent. E.S.A. Scale salary commencing £800 p.a. Other benefits.—APPLY ENG. DEPT., GENERAL ACCIDENT ASSURANCE CORP., LTD., 99, ALDWYCH, W.C.2. D 196

INSPECTION ENGINEER

INSPECTION ENGINEER—ELECTRICAL—required by North East Firm. Applicants should be between 25 and 40 years of age and be prepared to travel. Minimum qualification O.N.C. and preferably with some inspecting experience.—Please reply to BOX D 199, Offices of ENGINEERING, giving essential data and salary required.

MECHANICAL ENGINEER

MECHANICAL ENGINEER required, aged 25/35. Applicants should have a good University Degree in Mechanical Engineering with some workshop and plant construction experience. Alternatively, those having served a recognised apprenticeship with a reputable Engineering firm will be considered, if this is supported by good general education. Such applicants should have technical qualifications to at least Higher National Certificate standard and should be able to produce some evidence of having had responsibility for even minor installations. Knowledge of Chemical Engineering design will be an advantage.

The post carries sound prospects and is with a factory in the extreme East London area. Fullest information and salary required to BOX D 189, Offices of ENGINEERING, marking the envelope for the attention of the Chief Engineer.

INSPECTION ELECTRICAL ENGINEER

INSPECTION ELECTRICAL ENGINEER required for London Area. Applicants should be between 25 and 40 years of age with minimum qualification O.N.C. and with some inspection experience.—Reply to BOX D 197, Offices of ENGINEERING, giving essential data and salary required.

PRODUCTION MANAGEMENT

SOUTH WALES

ASSISTANT TO PLANT MANAGER

This new senior production appointment is to be made to the management staff of the South Wales factory of an expanding company prominent in the manufacture of synthetic resins.

Its initial responsibilities will include:—

1. The co-ordination of stock control, supply and distribution procedures for raw materials and finished products.
2. The co-ordination of production planning and control.
3. Production development related to new and existing plant manufacturing procedures, and handling methods.

Applicants for this position should be graduates in the age range 25-35 who have a good knowledge of chemistry and/or chemical engineering, and experience of production management work preferably in the synthetic resin industry.—Please write to BOX D 214, Offices of ENGINEERING.

The world's leading inventors and manufacturers of special purpose precision machinery for the Tobacco Industry have opening in their London Drawing Office for:—

SENIOR ELECTRICAL DESIGNER

Desirable applicant should be aged 30-40, with technical qualifications at least up to H.N.C. level, and with practical experience in the design and application of control circuits for small motors and electro-mechanical detector units. Some knowledge of electronics an advantage.

This opportunity is permanent and progressive; it offers immediate pensionable staff position with 3 weeks' Annual Holiday and attractive commencing terms. Applications stating age, qualifications and experience, should be personally addressed in confidence to

G. B. SALMON,

MOLINS MACHINE CO. LTD., Evelyn Street, London, S.E.8

D 140

British Titan Products Co Ltd

is seeking a

CIVIL ENGINEER

for the Chief Engineer's Department, Billingham, Co. Durham.

The Company is one of the world's leading concerns in its specialised field of Titanium Pigment manufacture and is presently engaged on an expansion programme of some £14 million at home and overseas.

This is a senior appointment which carries responsibility for all civil engineering aspects of new projects including foundations, steel and concrete structures, buildings, concrete vessels, etc. Duties will be mainly concerned with preparation of specifications, enquiries and approval of contractors' designs. A certain amount of design work is also carried out in the Company's own offices.

Applicants should be experienced civil engineering graduates of a British university in the age range 30-40.

Conditions of service in the Company are considered well above average and include a Non-Contributory Pension Scheme as well as housing and removal facilities for married men.

All applications will be treated in strictest confidence and should be addressed to:—

THE PERSONNEL MANAGER,
BRITISH TITAN PRODUCTS COMPANY LIMITED,
BILLINGHAM, CO. DURHAM.

quoting reference S.16. D 164

PROJECT ENGINEERS

Applications are invited from holders of a Degree or its equivalent in Chemical or Mechanical Engineering for permanent positions in our Company, which is engaged in the design, manufacture and erection of **TONNAGE OXYGEN PLANT.**

Previous experience in PROJECT ENGINEERING is essential and preferably in the chemical process or allied industries.

These vacancies are a result of our expansion programme and offer great opportunities to both senior and junior applicants.

Please apply giving full details to:—

Personnel Manager,

AIR PRODUCTS (G.B.) LTD.

49/50, Poland Street,

London, W.1.

D 194

MECHANICAL ENGINEER

A large National Company has a vacancy for a Mechanical Engineer in each of the following centres:

London
Cardiff
Glasgow
Manchester
Wolverhampton

The Company is an expanding one and future prospects are very bright. The need is for good calibre men aged 28/30 with experience in the heavy engineering of chemical fields. Candidates should preferably have at least an H.N.C. in Mechanical Engineering, or M.O.T. 1st Class Certificate (Steam and Diesel) supported by an engineering apprenticeship.

Please send details to BOX D 181, Offices of ENGINEERING.

ENGINEER

Research Laboratory Model Shop

AUSTRALIAN POST OFFICE—MELBOURNE

Duties: Group Engineer responsible for the Planning, Organisation and general supervision of the manufacture of experimental models, prototype and pre-production models of laboratory and telecommunication equipment developed by the Laboratories.

Qualifications: Degree in Mechanical Engineering preferably with Honours, with experience in workshop practice. Qualifications in Electrical Engineering an advantage.

Salary: £A1730-£A1950.

- **Permanent appointment.**
- **First class passage for appointee and dependants.**
- **Initial accommodation arranged.**
- **Salary from date of embarkation.**

Applications: Australian Post Office Representative, Australia House, Strand, London, W.C.2 *within two weeks of the appearance of this advertisement.*

D 182

MECHANICAL ENGINEER

Applications are invited for an appointment as a MECHANICAL ENGINEER in a large factory in Central Scotland for Maintenance and Development work on heavy plant; candidates should have a degree or equivalent qualification and some experience in work of a similar nature; interesting work, prospects of advancement. Staff Pension Scheme. —BOX D 188, Offices of ENGINEERING.

LIFT AND CRANE ENGINEER SURVEYOR

THE VULCAN BOILER & GENERAL INSURANCE CO. LTD. have a vacancy for a LIFT AND CRANE ENGINEER SURVEYOR in the London area. Applicants should possess a Higher National Certificate in Mechanical Engineering or a Frist Class M.O.T. Certificate (Motor). Age about 30 years. Commencing salary £800 rising to £1100 per annum. Non-contributory pension scheme.—Applications to 67, KING STREET, MANCHESTER, 2. D 186

ENGINEER

ENGINEER (about 30 years) required for CONSULTING ENGINEERS' OFFICE in MANCHESTER; Engineering degree and/or corporate membership of a major engineering Institution; varied industrial experience an advantage. Technical investigations and reports in matters where litigation is being considered.—BOX D 184, Offices of ENGINEERING.

MECHANICAL ENGINEERING DRAUGHTSMEN

MERZ AND McLELLAN have vacancies in their Esher Office for MECHANICAL ENGINEERING DRAUGHTSMEN. Preferred age limits 25 to 35. Applicants should be experienced in Plant Layout Work, Preferably, but not essentially, in connection with Power Stations. Salary will be fully appropriate to experience, rising from about £870 per annum at age 25. Excellent working conditions. Pension Scheme. Canteen.—Apply in writing to MERZ AND McLELLAN, MILBURN, ESHER, SURREY. D 183

TEXTBOOK REPRESENTATIVE

Scientific and Technical publishing. A well-known London Publishing House wishes to appoint a TEXTBOOK REPRESENTATIVE to visit technical colleges in all parts of the United Kingdom.

Applicants, between the ages of 30 and 40, should have some experience in technical education and preferably reside in London or the Midlands. Salary £900-£1000 p.a., with prospects of further advancement. A car and reasonable expenses will be provided.

Details of present and previous appointments should be sent with application to the address below. BOX D 210, Offices of ENGINEERING.

HEATING, VENTILATING AND LIGHTING ENGINEER

A HEATING, VENTILATING AND LIGHTING ENGINEER is required to augment the specialist services now provided by PEKA. The successful applicant will act as an advisor in these subjects to firms throughout the country, and will carry out his assignments at the various Companies. Applicants should be conversant with boiler efficiency tests and the specification of factory services systems. Essential qualities include enthusiasm and ability to work on own initiative. Superannuation under F.S.S.U.—Send details of training, experience and present salary to SECRETARY (L.751), PRODUCTION ENGINEERING RESEARCH ASSOCIATION, MELTON MOWBRAY, LEICS. D 208

MECHANICAL OR PRODUCTION ENGINEER

MECHANICAL OR PRODUCTION ENGINEER, with highly developed qualities of leadership and initiative, and experience in writing or editing technical reports required to take charge of a translation group at a well-known and rapidly expanding organisation in the East Midlands. This appointment offers very considerable scope for development in addition to a good starting salary, excellent superannuation scheme, and pleasant surroundings. —Send full details of present salary, training and experience quoting L.750 to BOX D 207, Offices of ENGINEERING.

A SENIOR DRAUGHTSMAN

experienced in plant layout and services who requires work of unusual variety and scope in a secure branch of industry is invited to join the Drawing Office of H. J. Heinz Company Limited at their Head Office in North West London.

The Company occupies a leading place in the expanding food industry and the appointment offers a position which is permanent and progressive with employee benefits including a non-contributory pension scheme.

The successful candidate's duties will be concerned with plant layout, vessel design and general factory services, and a commencing salary up to £18 per week is proposed.

Please apply with full details of past employment and education to the

PERSONNEL OFFICER,
H. J. HEINZ COMPANY LIMITED,
WAXLOW ROAD,
HARLESDEN, LONDON, N.W.10.

D 178

ENGINEERS

are required at Dounreay Experimental Reactor Establishment, to be responsible on shift for the management and direction of Engineering staff who will be engaged in new work, repair and scheduled maintenance on the Fast Reactor and its associated ancillary equipment.

Applicants must have served a recognised engineering apprenticeship and be corporate members of a senior engineering institution, or have equivalent qualifications. These posts would especially suit engineers with shift experience from the heavy engineering or chemical industries or watch keeping engineers from either the Royal or Merchant Navies.

Salary on scale £1370-£1825, according to age, qualifications and experience.

Contributory Superannuation.
Housing Assistance Schemes.
Hostel accommodation available.

Send postcard for application form, quoting reference 410/J.2, to

Personnel Manager,

UNITED KINGDOM ATOMIC ENERGY AUTHORITY

D.F.R.E.,
Thurso, Caithness, Scotland.

D 170

ELECTRICAL ENGINEER

An important British Gold Mining Company in Ghana wishes to appoint an Electrical Engineer. The successful candidate will be responsible to the Chief Engineer for the maintenance of all electrical plant and machinery on the surface and underground and for the installation of all new electrical equipment. He should have experience in power generation and distribution and in the maintenance of records and ordering spares. Previous Mining Engineering experience essential; technical qualifications at least up to H.N.C. (Electrical) standard.

STARTING SALARY NOT LESS THAN £1750 per annum

Tours abroad are for 15 months followed by 3 months' paid leave, passages and housing provided. The post is healthy and suitable for children. The appointment is permanent and pensionable. Income Tax at low local rates.

Applications, which will be treated in confidence, should give details of technical training, practical experience and positions held and should be addressed to BOX D 187, Offices of ENGINEERING.

DRAUGHTSMAN

DRAUGHTSMAN required with or desiring experience in railway carriages and wagons or diesel traction. Man with good general or structural engineering experience considered. Superannuation scheme in operation. Salary commensurate with qualifications and experience.—Apply:

THE SECRETARY,
THE BIRMINGHAM RAILWAY CARRIAGE & WAGON CO. LTD.,
SMETHWICK, 40, STAFFS.

D 160

TECHNICAL AUTHOR

TECHNICAL AUTHOR required, not over 50, to undertake the compilation of operating and maintenance instruction manuals dealing with the Company's machinery. This interesting and progressive pensionable staff position would appeal to a suitably qualified Mechanical Engineer with a bias towards technical writing.—Applications should be addressed to the

Personnel Manager,
Molins Machine Company Ltd.,
Evelyn Street, London, S.E.8

D 114

APPOINTMENT WANTED

COMPANY ACCOUNTANT (INC.)

Company Accountant (Inc.)-Office Manager with several years foreign experience desires to hear of vacancy in Middle East, Central or South America. —BOX D 200, Offices of ENGINEERING.

COMPANY MEETING

THE TAP AND DIE CORPORATION

Unprecedented Activity

Presiding at the Tenth Annual General Meeting of the Corporation, Mr. D. G. N. Lloyd-Lowles, the chairman, referred to the period under review as one of unprecedented activity and said that the accounts reflected for the first time the Group's two new acquisitions, The International Twist Drill Company Limited and John Harris Tools Limited. As a result of these acquisitions the Group's standing in the small tool industry had been further enhanced.

Reviewing operations the chairman said that all three London companies had enjoyed exceptional prosperity and had achieved record sales at home and abroad. Taken all in all they represented a Group greatly strengthened in every way and one that had not only achieved much already but had still a great future before it.

The nominal capital had been increased from £1,500,000 to £3,000,000, of which £1,675,000 had been issued and the Reserves of capital and Revenue now amounted to £1,857,298. Profits before taxation, but after all other expenses, had risen from £314,691 to £820,814 (which included profits of International Twist Drill for 17 months and of John Harris Tools for 13 months); adjusted to a 12 months' basis in order to give a truer comparison, that was equivalent to £709,300.

A final dividend of 11½ per cent, less tax, on the increased capital (making a total of 17½ per cent, less tax, for the year) was recommended, plus a Tenth Anniversary bonus of 2½ per cent. With regard to future prospects, the chairman said that if current trading was any guide they should reach new records again this year.

D 130

ADVERTISEMENT RATES

'Engineering' Appointments Section

CLASSIFICATIONS: Public Appointments, Appointments Open, Appointments Wanted.

TYPES OF ADVERTISEMENTS:

(a) "Appointments Illustrated" and illustrated careers advertisements: photographs or drawings may be used in conjunction with type matter.

Rates:	per page (12 in. by 9 in.)	£100
	half page	£54
	quarter page	£29

(b) Semi-display: type matter, with or without surrounding rule, name block or symbol.

Rates:	per page (12 in. by 9 in.)	£100
	per half page	£54
	quarter page	£29
	per single column inch	£2 14s.

(c) Single column "run-on" advertisements: approximately 6 words to the line, 12 lines to the inch.

Rate per line	4s. 6d.
(Minimum charge 18s.)	

SERIES DISCOUNTS: 5 per cent. on 6 insertions; 10 per cent. on 13; 15 per cent. on 26; 20 per cent, on 52.

BOX NUMBER: 2s.

COPY DATE: First post Monday.

BLOCKS: To be mounted ready for printing. Screen 100.

ORDERS TO: "Engineering" 36, Bedford Street, London, W.C.2. (Telephone TEMple Bar 3663).

Company Meetings

COPY DATE: First post Monday.

BLOCKS: To be mounted ready for printing. Screen 100.

ORDERS TO: "Engineering" 36, Bedford Street, London, W.C.2. (Telephone TEMple Bar 3663).

Companies

A Great Clydeside Company

THE 136 year long path of the FAIRFIELD SHIPBUILDING AND ENGINEERING Company, whose yards are at Govan on the Clyde, stretches from the setting up in 1834 by two Glasgow men as millwrights through to the present agreement with MITCHELL ENGINEERING for the study and development of marine uses of nuclear energy.

The founding millwright business, prospering steadily through the 1840's was joined by John Elder in 1852 and for many of the early years the firm owed its name and much of its fortune to this outstanding engineer. A year after joining the firm he had patented the compound engine. Others of his ideas included the predecessor of the modern water tube boiler.

Under Elder's lead the company became one of the most sought after marine engine makers in the world. By the later 1850's they were producing the machinery for the Pacific Steam Navigation Company and in 1960 were asked to build a ship—the Macgregor Laird.

Atlantic Blue Riband

The Macgregor Laird was the forerunner of an expanding fleet of Fairfield built vessels. Within four years the flow of orders to the firm justified the purchase of a farm which became the present Fairfield site. In those early yards were built a number of celebrated American Civil War blockade runners and logical development led on to fast packet boats.

John Elder's sole command of the firm lasted only 15 months, being cut short by his death in 1868, though the company continued in his name. The present title was adopted in 1886 when the firm was registered as a limited liability company. Seven years earlier the yard had one of its greatest successes with the Guion liner Arizona, a winner of the Blue Riband of the Atlantic. At a time when the Government has decided to support Cunard in the cost of a new luxury trans-Atlantic liner, it is worth recalling that Fairfield 80 years ago were producing a succession of fast Atlantic liners on the Clyde.

Remarkably swiftly built, in the 1890's, was the Hamburg-America line 8,000 ton vessel Normannia, the first twin screw liner from the Fairfield yard. She was completed in 281 days.

From 1863 the yard had been working for the Royal Navy. Towards the end of the century, as the international climate fell, Fairfield work for the Navy increased. The yard built some early destroyers, smaller cruisers, the larger armoured cruisers Cressy and Aboukir and small scouting cruisers. First World War building included the battle cruiser Renown and the battleship Valiant. In addition to a programme of light cruisers and destroyers nine submarines were also constructed.

Between the wars Fairfield changed hands more than once. When the widow of Sir William Pearce died—he was the man who set up the association with the Canadian Pacific—her stock holding was bought by the former Northumberland Shipbuilding Company. While they had command of the yard some famous ships, among them the Empress of Japan and the Athenia, were built.

In the slump a new chairman took over and when some recovery was made with new naval orders in 1933, and the "scrap and build" scheme began to take effect, the company ran into a shortage of cash to provide for the new orders. This situation led to another change of ownership, to the present position in which Fairfield are a member company in the LITHGOW Group, with their own board led by Sir John Erskine, whose background is legal and financial.

Answer to Critics

Two cruisers and 18 destroyers were built and engined by Fairfield in the Second World War and the largest British battleship of the war, the 35,000 ton Howe was a Fairfield product.

Since the war a revolution has been going on in the yard. Individual handling of plates has given way to considerable prefabrication, the main fabrication shop is over 70 ft high and 1,000 ft long, stretching from one end of the berths to the other. Fairfield can and does build up to 65,000 ton vessels, and will be doing so in tanker form for BRITISH PETROLEUM.

The Mitchell Engineering agreement covers not only the development of the use of nuclear energy for marine propulsion but the design, manufacture and sale of marine nuclear machinery.

The post-war development of Fairfield is an important part of the answer to the industry's less informed critics.

Swedish Turbine Makers Looking Ahead

Every schoolboy knows that Sweden has large hydro-electric power resources. But the directors of the DE LAVAL LJUNGSTRÖM turbine company, of Finspong, Sweden, know that before very much longer all the Swedish hydro-electric power resources will have been tapped.

For this reason they look forward to an expanding turbine market in their home territory. The demand is expected to be for fairly large condensing units, equipment which De Laval Ljungstrom is in a strong position to provide.

But the Swedish market is not the greatest consideration of the company. Since the war two-thirds of its output of stationary turbines have gone abroad. Export sales have been made in about fifty countries, much of the business being in the Far East and Australia.

Licence Arrangements

Cooperating with KOCKUMS MEKANISKA VERKSTADS, the company are to manufacture two 27,000 h.p. marine turbines, which will be the largest tanker turbines in the world. The trend towards greater size is emphasised by the directors in their annual report. Orders on which the company is engaged include turbines of 60 MW for Denmark and the Netherland, 30 MW for Finland and 25 MW for Belgium.

Earlier this year a manufacturing licence granted to the Glasgow firm ALEXANDER STEPHENS AND SONS came into effect.

The De Laval concern also produce refrigerating machinery and pumps. In both these sections of their work sales were at the highest levels yet reached. The De Laval refrigeration plants go to ships, stores, breweries, dairies and into restaurants and similar applications. The technical development in the turbine sector is aiming at better running reliability, improved fuel economy and more extensive automatic control. The intense international competition means that constant cost control is enforced.

An interesting aside on the way in which the group is made up is given in the breakdown of pay for manual and salaried employees. The manual workers received £1,445,600 during 1959 and the salaried staff £1,461,500. There were rather more than 1,700 workers and 1,250 staff employed during the year.

Red Diamond for University Expeditions

When the Oxford University expedition left for Cyrenaica, and the Cambridge team for Buenos Aires both were equipped with full sets of hand tools

for servicing their vehicles, provided by GARRINGTONS, the Worcestershire tool manufacturers.

The Oxford expedition to Cyrenaica used a 3 ton Bedford truck, the Cambridge men were using Land Rovers. The picture shows the Red Diamond tool sets being packed for dispatch.

Ford's Sum Up the Car Position

The increased interim dividend announced by the FORD MOTOR Company, and the warning that income over the current six months will probably fall back to the level of the last half of 1959, is a clear indication of the speed with which the car firms can enter and leave a spell of high prosperity.

The sales levels of the second half of last year were records in themselves so that what the car firms have been losing is the cream off the top rather than their bread and butter, not that that is much consolation.

The information from Ford's, added to that from VAUXHALL's and others in or associated with the car business, confirms that the hire purchase restrictions and the difficulties in maintaining sales into the United States are and will reduce the earnings probably for some months more of the assembly plants and of their components suppliers.

The detailed Ford half yearly statement shows how in the first six months increasing sales were accompanied by dwindling profit margins. January to June sales were £151 million, an increase of 29 per cent over the previous year. In the same months the trading income of £21 million showed an improvement of 21 per cent.

Germany's Nuclear Scientists Become Critical

For some months now the research centre at Geesthacht near Hamburg has been studying the application of nuclear energy to marine propulsion. The centre is operated by the Hamburg Society, the GESELLSCHAFT FUER KERNENERGIEVERWERTUNG IN SCHIFFBAU UND SCHIFFAHRT, and has a 5,000 kW research reactor. The Society was founded in 1957 and is supported by the Bonn Government, the North German States and various shipping, shipbuilding and other industrial concerns.

Much was expected of this venture. In fact it has run into difficulties not of a technical but an administrative kind. The resignation of its director, Professor Kurt Illies, a leading pioneer in this field, is reported. The grounds for the resignation are "that freedom of research in the Geesthacht venture is no longer guaranteed."

This news has brought into the open a feud between the scientists and the industrial concerns involved that has apparently been smouldering for some time. The practical work arising from the activities at Gaesthacht is being undertaken by Interatom which is jointly owned by Atomics International of Canoga Park, California (a division of North American Aviation) and Demag of Duisburg.

What is all the rumpus about? According to one of the chiefs of Interatom the scientists take too long in getting results so that the practical work is held up. A large number of experiments are said to have been carried out to decide on the most suitable type of installation. But no practical development work has resulted from these.

Divided Approach

To get over these organisational snags the society's management structure is being changed. There will now be two managing directors, one responsible for administrative matters, the other for technical tasks. The scientific research will be carried out by three departments each working under a professor who in turn will be responsible to the two managing directors.

At the moment it is estimated that about half a year has been lost through delays and disagreements. Can this time be made up? The most optimistic view is that the first German ship with nuclear propulsion could if all goes well be ready by the end of 1961. Tenders for the construction of the first atomic vessel however will probably not be invited until mid 1961, by which time it is expected that a reactor suitable for installation in a ship will have been developed. The total cost of the project—reactor, ship and testing—is estimated at around 50 million D marks (between £4 and £5 million).

One side line of the failure of the scientists and industrialists to get on is that the German press is blaming the oil companies for the delay. Several oil concerns are involved in the financing of the Centre and the allegation is that they are upset at the rapid progress being made in nuclear marine propulsion. This story, which has of course been denied, is one of the less serious aspects of an incident that has thoroughly upset Germany's scientists.

Why Make Chips as well as Products?

One of the objects of the production engineer is to make more product and less waste. The solution is in non-chip producing metal working processes.

WHATEVER the " city " might do with the bank rate, the economic progress of the United kingdom depends to a very large extent upon the efficiency of the producer industries. Given a certain product to make, it is the duty of the production engineer to waste neither the efforts of his men nor his basic materials. This article is concerned with the latter point—avoiding material wastes—in the metalworking industries.

The importance of this philosophy cannot be over emphasised for it is easily forgotten amid the clamour for more sophisticated chip producing machine tools.

It is worthwhile noting the words of an Enims (the Russian Experimental Scientific-Research Institute for Machine Tools) spokesman who is reported as saying that " the main purpose of machine tools is to make articles, not chips." It is also significant that at the recent Brno Fair, the machine tool section was divided into two groups—for machine tools producing chips and those which do not.

This is evidence of the way Czechoslovak production engineers must be thinking. The United Kingdom's efforts in this direction should not be underestimated, however, for it was the Czechs who this year awarded one of two medallions for contributions to technological and scientific progress to Mr. F. Griffiths, the chief production development engineer of the British Motor Corporation. This year and last year, Mr. Griffiths contributed to Czech symposia on automation and machine tools. The theme of these contributions was the avoidance of wastes. The second medal went to Professor Lazarenko of Russia who is known for his work as the father of spark erosion.

It also appears that the Institution of Production Engineers in this country are very aware of the importance of this trend, for their conference currently taking place at Brighton is concerning itself with " Modern Trends in the Manipulation of Metals." This conference is split into four main groups, namely Extrusion Techniques, Precision Forging, Forming by Rolling and Sheet Forming. Reports on the first three of these groups are included in the following.

Moving rather than Removing by Roll Forming

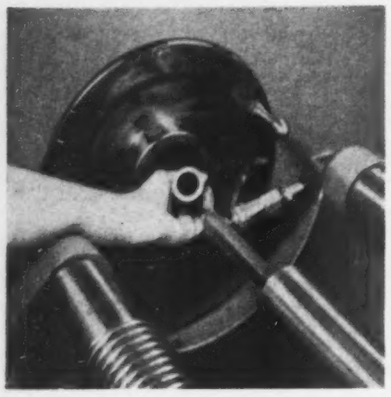
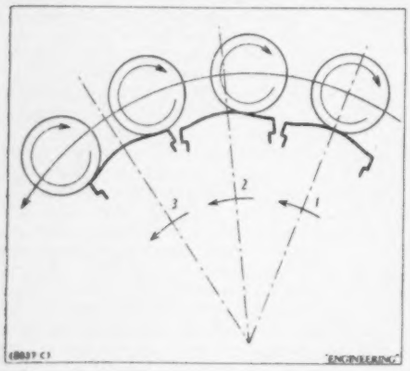


Fig. 1 (above) Hollow stock before Intraforming.

Fig. 2 The cam top has a sine wave profile.



A relatively new chipless machining process of which little is known in this country is the Cincinnati Milling Machine Company's Intraform process. Briefly, what happens in the process is that hollow cylindrical stock, such as that shown in Fig. 1, is placed over a mandrel and squeezed by a number of rapidly pulsating dies. When the operation is complete, the mandrel profile has been reproduced in the inside diameter of the part.

Four forming dies are used in the process. These pulsate rapidly while revolving round the outside diameter of the workpiece. The dies, mounted on cams, are made to pulsate through contact with a series of free wheeling, hardened steel rollers located in the machine headstock. Fig. 2 shows how a cam passes from one roller to the next to produce the pulsating action of the die. As they rotate, the cams never lose contact with the rollers.

As Fig. 2 shows, the top surface of the cam has the form of a sine curve. Since the cam never loses contact with the rollers as the dies revolve around the workpiece, this sine curve profile results in a smooth and continuous squeezing action on the part of the dies. There is no hammering effect.

Fig. 3 shows the mandrel and the four dies with the workpiece passing between them. The completed part drops into a discharge chute when it has passed right through the dies and the mandrel is retracted to accept another blank.

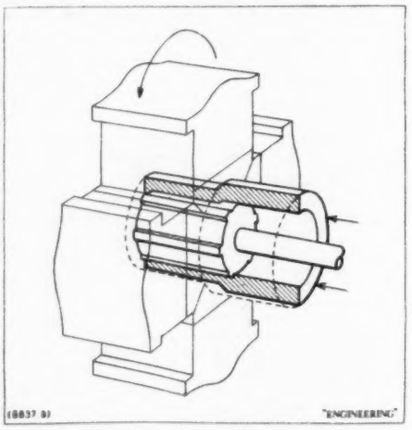
As the dies form the workpiece to the shape of the mandrel, contact with the rotating dies causes the part, and therefore the mandrel, to revolve at about 80 per cent of the die speed. Since the workpiece feeds, but the mandrel does not, long workpieces can be formed with a short and, therefore, relatively cheap mandrel.

Besides the application already mentioned, the process can be used to produce laminated tubing of two dissimilar metals. For example, aluminium electrical conduit tubing has been produced with a bonded copper lining. Because a strong tight bond is produced, operations such as joining ferrules or terminals to cables can also be carried out.

With the exception of the last example, the applications mentioned so far have required the use of a mandrel. Operations of a different type, for which a mandrel is not required, can also be carried out on hollow workpieces. These include reduction of tube diameters and the formation of tapered tubular parts. Similar operations can also be done on solid workpieces.

Because this process " moves " metal rather than " removing " it, less stock is required than for conventional machining operations. These savings can be very significant, particularly when coupled with time savings over alternative processes.

Fig. 3 The workpiece passing between the dies.



Precision Forgings Make Big Savings

It is true to say that precision forging is one of the most simple means whereby a reduction in conventional chip producing machine shop processes can be achieved. It is becoming vital that forgings should be consistently accurate dimensionally and free from flashline.

To this end, great strides forward have been made during the past ten years by designers of forging plant in producing profiled parts of both simple and complex forms. Bevel toothed and internal toothed gears combined, with adjacent forms and projections included have been forged. Hitherto they would have been out of the question. A wide variety of such forgings can now be produced quickly and dimensionally accurately. They can be produced consistently to a weight within 2 or 3 per cent of the finished machined article—so achieving material economies to the order of 30 per cent and even 50 per cent by weight alone, in comparison with normal stampings. Rough finishing can be practically eliminated by these methods, leaving finishing to be done by light turning, milling or grinding.

One of the conference papers was particularly concerned with the possibilities of plant for producing multiple diameter shaft components by these precision forging methods.

Said to be foremost in this field is the type of forging machine incorporating multiple hammers of simple pattern and profile, arranged to reciprocate at high speed while a heated steel billet is passed automatically between them to be swaged down to a preset pattern of diameters and

lengths. Contrary to normal upsetting methods, this particular process of precision forging reduces material from large to smaller cross-sectional areas, while at the same time stretching it longitudinally.

The technique is different from the usual forging methods in the following principal respects. Firstly, because the required total reductions of size in a piece are achieved with a series of swaging operations carried out at high speed using a method which divides the forging forces among a number of small blows, it has been possible to make machines comparatively small in size and weight in relation to the size of components they can process. Thus the floor space requirement is reduced.

Secondly, the finished form of the piece is not governed by the shape of the dies only, but also through the medium of adjustable stops, and, in certain circumstances templates. In this way, it is possible to produce forgings over a wide range of diameters and lengths using only one set of simple and inexpensive tools. Because of this, small batch quantities can often be justified when the cost of die manufacture might be prohibitive using other forging methods.

So far as dimensional accuracy is concerned, tolerances of $\pm 0{\cdot}010$ in are guaranteed for diameters up to $2\frac{1}{2}$ in, and straightness is guaranteed within $\frac{1}{16}$ in for lengths up to 24 in.

Surface finish is good enough for machining to be unnecessary on the non-bearing surfaces.

In this style of machine, a pre-heated billet is loaded into and held by a chuck during processing. The chuck is pneumatically operated and motor driven to rotate the billet while feeding it automatically through the reciprocating forging hammers arranged symmetrically around the work. The construction of this chuck is such that all forces exerted upon it are absorbed by spring cushions and special rubber pads to eliminate vibrations.

The principal part of the machine is the forging box, containing reciprocating shafts driven from fast running eccentric bushes and transmitting their movements through guided connecting rods directly to their respective forging hammers. These reciprocating shafts, three or four in number according to machine type, are arranged about the work as already stated and their movements synchronised so that the forging actions take place at all points on the same axis at the same time.

In this way, the forging blows are brought into equilibrium and the machine foundations are not affected by transmitted vibrations.

Shafts are pressure lubricated, guides water cooled, and hammers air cooled, to extract as effectively as possible the heat absorbed from billets. It is interesting to note in this respect, that temperatures for forging by these methods are much less than those necessary for other methods, and that maintenance of a set temperature is not critical. This keeps down furnace operating costs and helps prevent the formation of scale.

Control of these machines is primarily hydraulic. They are fully automatic in operation and once a forging cycle has been started it continues until the work is completed. Except for the starting of the machine, an operator's only responsibilities are the loading of billets and the unloading of finished pieces.

The various diameters and lengths are set by means of stops on horizontal and vertical cycle control drums within the main frame of the machine; the hydraulic control system being arranged in such a manner that diameters and corresponding lengths between shoulders are forged successively in a single cycle.

By means of adjustable throttle valves controlled from trips on these drums, forging speeds are chosen automatically in accordance with the surface finish qualities required for the different diameters.

Tapered diameters up to a maximum included angle of 20° can be included.

On some of these machines, electronic control systems can be fitted. It is also possible in some cases to profile forge through the medium of a manually operated tracer head, copying directly from a drawing mounted on a control desk adjacent to the machine.

Cold Impact Extrusions in Steel

Experimental work has been going on for some time at the National Engineering Laboratory on various aspects of the extrusion process, including the cold impact extrusion of both ferrous and non-ferrous metals.

Although the process has been known for a considerable time, its application to the stronger metals is only fairly recent in origin. It is now being applied to larger and longer products in many materials including the more exotic types such as molybdenum, zirconium, uranium and titanium. Material savings of 50 per cent are common using this process and they sometimes rise as high as 90 per cent. This saving plus other advantages of improved output, quality and dimensional accuracy together with the ability to produce simply a wide range of shapes, has resulted in the rapidly growing importance of cold extrusion for both ferrous and non-ferrous materials. Both the dearth of information and the effects of many variables, particularly in the case of steel, has tended to delay the application of this process.

Except for very simple products, the technique consists of a number of operations carried out in sequence or sometimes simultaneously and involves forward extrusion, backward extrusion, upsetting piercing, coining and the like. Thus the tooling for the working and transfer of components might be quite complicated and costly, particularly for steel. In such cases, the process can only be economical if large numbers of products are required.

The process is particularly suited to the production of axially symmetrical components. The solid components can be made with heads of all shapes or with stepped shanks of different diameters, while hollow components can be completely closed at one point. Both the inner and outer surfaces of hollow components can be produced with lands, flutes, splines or teeth. Thus a wide range of components is possible, such as cans, tubes, screws, bolts, studs, pins and rivets in both types of material as well as steering ball joints, motor spindles, gudgeon pins, hydraulic cylinders, spark plug bodies, torsion tubes and motor transmission gears in steels.

Steel was first successfully extruded in Germany in 1934 to provide an alternative process to deep drawing. Due to the fact that the stress system in extrusion is essentially compressive, whereas it is entirely tensile in deep drawing, it is possible for the same deformation to be obtained in one impact extrusion, as opposed to several deep drawing operations with inter-stage annealing treatments.

The process has been under continuous development during the last 20 years in Germany and its range of application widened and its capabilities proved under commercial conditions. In the USA, government sponsored research and development work at two firms immediately after the war has led to the knowhow and industrial techniques which exist in that country at the moment. While developments abroad have been known for a number of years, it is only recently that the possibilities of the cold extrusion of steel as a production process have been generally explored in this country. The slowness in applying such processes may have been due to lack of incentive, but it is more probably due to a complete lack of expert knowledge of a new technology.

In order to provide data and an adequate background for the new process, a study has been made of the various factors governing the cold extrusion of steel. This study is reported in NEL Plasticity Report No. 163.

While this research effort was restricted to a limited range of products and materials, the same general principles apply and the data obtained can be used in the consideration of the production of specific engineering components giving the required information on press loads and tooling stresses at each stage of the process.

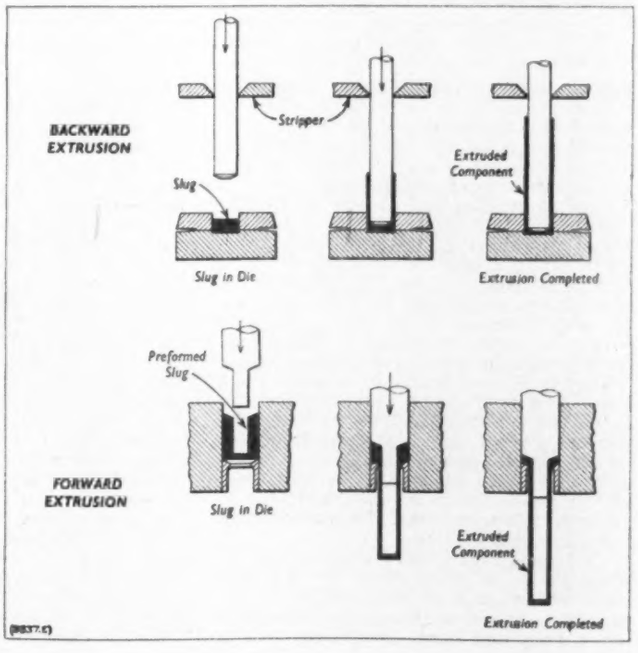


Fig. 4 The forward and backward extrusion processes are shown here schematically.

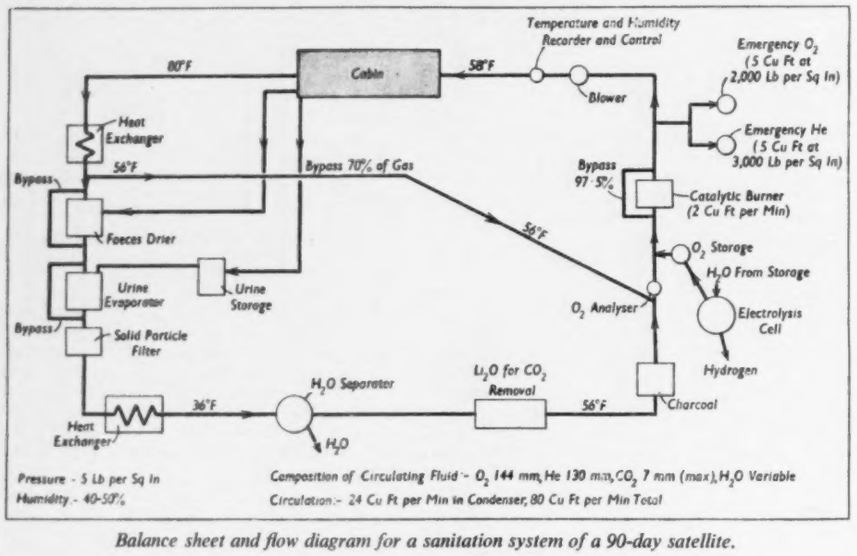
Sanitation in Space Means Recycling

With manned space flight beginning, proper and effective sanitary arrangements will have to be made within the capsules.

By G. V. E. Thompson, B.Sc., B.Sc.(Eng.), F.R.I.C., F.B.I.S.

IN SPACE, man will encounter many new conditions and these may lead to some changes in his physiology. However, if he is to remain alive and in good health his bodily functions of breathing, eating, drinking and excretion must continue in much the same manner as they take place on Earth. As in the case of other long-distance vehicles, it will be necessary for the designer to provide for all these activities. The vessel must carry sufficient oxygen, food and water for the entire trip, and equipment for handling the human wastes that will be produced.

These wastes include not only urine and faeces, but also expired carbon dioxide and water vapour, sweat and gases. These gases contain some poisons and a high proportion of methane; apart from the physiological and psychological reasons for removing them, on a long voyage they could eventually produce an explosive atmosphere if allowed to accumulate.[1]



Balance sheet and flow diagram for a sanitation system of a 90-day satellite.

Methods used for treating wastes will obviously depend upon the duration of the mission. For short flights in ballistic missiles or rocket aircraft, no waste recovery is necessary, as the pilot will not have to eat or drink during the operation and would not have had a heavy meal before starting.

For missions lasting a day or two, such as several orbits around the Earth in a minimum manned satellite, or a trip out into sub-lunar space, it will be necessary to collect urine, but by careful selection of the diet it should be possible to avoid production of solid wastes. In early vessels for this type of voyage, the cabin is likely to be quite small, and the pilot would remain in a contoured seat and be encased in a pressure suit throughout the mission. The equipment would have to function under conditions of zero gravity, and would probably consist of a tube attached to the body, fitted with a non-return valve and leading to an evacuated plastic container. No attempt would be made to treat the waste.

This arrangement would even be suitable for circumnavigation of the Moon, but not for a trip involving a lunar landing, where there would probably be at least two persons spending perhaps ten to fifteen days there. Space suits would be worn during the journeys from and to the Earth, and while outside the vehicle on the Moon's surface; these would be provided with receptacles for urine. However, the astronauts are likely to spend about half of the time inside the spaceship cabin, either resting, feeding or examining minerals, making notes, and so on. The cabin could be provided with an aircraft-type toilet (modified to take account of the reduced gravity), and when the time came to return to Earth, this would be sealed and left behind until a large enough base had been established to undertake proper disposal of wastes.

In all the missions considered so far, it would be possible to purify the atmosphere by absorbing the carbon dioxide and excess moisture with chemicals. The atmosphere could be regenerated by use of a standard liquid oxygen gasifier.

From a propulsion point of view, trips to the vicinity of Mars or Venus are not much more difficult than circumnavigation of the Moon (an American instrumented satellite has already been sent near to the orbit of Venus); the navigation problems are not insuperable. However, manned flight to these planets (even without landing) is much more difficult than manned flight to the Moon or even than transporting an equivalent mass of instruments to the planet concerned. The journeys would last many months—perhaps several years—and sufficient provisions for this period must be taken on board before leaving. The quantity of waste products to be disposed of will also increase in proportion to the duration of the trip.

It has sometimes been jocularly suggested that disposal might be by the time-honoured method used by British Railways—discharge through a pipe leading outside the vehicle. The vacuum in space would assist the discharge and the velocity imparted to the material should be sufficient to remove most of it from the vicinity of the vehicle. The method would be less insanitary than on the railways, because living organisms in the waste would perish and any solid residue that returned to the Earth would be incinerated on re-entry into the atmosphere.

Quantitative consideration of human metabolism shows that even if this process is not rejected on aesthetic grounds, it is uneconomic.

The human body is essentially a heat engine. The food it consumes is the "fuel," and is "burned" directly or indirectly with the air breathed in; as usual, the "flue gases" consist of carbon dioxide, water vapour and excess nitrogen and air. The energy released is partly used up in performing mechanical work and partly released as heat. As in the case of the steam engine, there is a working fluid (water), though its function is somewhat different—it helps to convey the fuel into the furnace and to remove the ash (faeces and urine solids.) Even if water is not imbibed directly, it is the major constituent of most foods.

Actual figures for "fuel consumption" are obviously dependent upon the size of the "plant" and whether it is working at full capacity or not. The occupant of a spaceship is likely to lead a fairly sedentary life; little physical activity is needed to carry out his tasks, and it will probably be necessary for some exercises to be done to keep in good condition. The daily metabolic quantities shown in the Table are based on the assumption that the man concerned weighs about 10 to 11 stones and undertakes only moderate activity over a length of time. The body mass must remain practically constant.

TABLE:—*Daily Human Metabolism*
(Average man, moderate activity, approximate figures

Input	
Water (including content of food)	5 lb
Oxygen	2 lb
Solids (minerals, foods, dry basis)	1 lb 2 oz
Total	8 lb 2 oz
Output	
Water	5 lb 11 oz
Carbon dioxide	2 lb 4 oz
Solids (dry basis)	2 oz
Methane	(0·3 litres)
Total	8 lb 2 oz
Net heat output	12,000 Btu

Notes—1. Input and output masses will be equal, as body mass remains practically constant.
2. Nature of diet will affect relative proportions of products, fat producing more water than proteins or carbohydrates.

It will be noted that the output of water is actually greater than the amount taken into the body, the difference being due to "combustion" of hydrogen in the food. Now each pound of mass carried as cargo will require the expenditure of several hundred pounds of propellent, and extra propellent means extra tankage space, extra take-off mass, and more massive launch facilities. Considerable economies will be possible, if instead of rejecting the waste products they are processed to recover the water and this is re-cycled. If the oxygen and solids could also be regenerated, a further economy would result, although the gain is not so marked and the process is not so easy to bring about.

PHYSICOCHEMICAL TREATMENT

Research on waste treatment processes for spaceflight has been proceeding in America for several years now[2 3 4]; little has been published concerning Russian work in this field, but as the Russian space programme is mainly aimed at manned space flight, it is likely that they are not lagging behind. The methods investigated may be broadly classified into physicochemical and biological techniques.

Physicochemical methods are based on the use of the ordinary unit operations of chemical engineering. The Martin Company has been carrying out a design study on a waste treatment system for a one-man 5,000 lb satellite designed to stay aloft in a 90 minute orbit for 60 days before recovery,[1] and Fig. 1 shows the essential flow-sheet of the process. The urine is stored, treated with a trace of silver salt to destroy any bacteria, and periodically passed to an evaporator containing a series of perforated silver-plastic baffle plates to break up the liquid into fine spray. Part of the stale air from the life compartment is

passed through this evaporator, and then the saturated gas goes to a heat exchanger and is cooled to 36° F to condense the water vapour. The water is removed from the gas in a centrifugal separator and passed through a silver/charcoal bed to remove any traces of impurities. The flowsheet indicates that water may also be recovered from the faeces by drying, but it is doubtful whether the quantity concerned is worth this extra complication.

The gas leaving the centrifugal separator is passed over lithium oxide granules to remove carbon dioxide. This is the best non-regenerative absorbent available for the purpose, but on a longer journey with nuclear power available it would be possible to use lime and then heat to regenerate pure carbon dioxide for further processing. Instead, the deficiency of oxygen is made up by electrolysis of some of the excess recovered water. Periodically, the "reconstituted air" would be passed over a platinum coil heated electrically to 500° C, to burn up any methane or hydrogen which had accumulated. The by-product hydrogen from the water electrolysis cell would be used as the heat exchange medium to cool the air leaving the life compartment, and to remove the heat from the satellite's electronics compartment. It would be recirculated after being cooled by radiation to space; excess gas would be vented to space.

This system has been designed with a capacity large enough to permit treatment of water used for washing; this is added to the urine before processing . Because of the absence of gravity, transfer of water outside the pipework and tanks will have to be done in enclosed containers, probably thin plastic bags. Washing will have to be done with a moistened sponge.

Briggs[5] has suggested alternative methods of separating pure water from the liquid wastes: distillation (using either electrical heating or direct sunlight) or ion exchange chromatography. The second method has the merit of simplicity, but awaits the development of suitable resins. At least the drinking water would be sterilised with antibiotics or silver.

NASA has recently awarded the US General Electric Company a $94,000 contract to continue work on a process of water recovery using a technique called vacuum pyrolytic catalysis. The exact details of the process have not been disclosed, but it is said to involve vaporising substances from biological wastes at reduced pressures and low temperatures, then heating the vapour and condensing. The condensate is claimed to be free from odour, colour and toxic materials, and to be potable without filtering or addition of chemicals. Prolonged tests on feeding the recovered water to rats and monkeys are to be made.

BIOLOGICAL TREATMENT

Whatever method of water recovery is used, some solid material will accumulate—mainly faeces, but also urea and salts from the urine and wash water. A man's daily excretion of faeces is about 4 to 6 oz, and the solid content amounts to about 1 to 1½ oz. As indicated above, treatment of this would not be worth while in a 60-day one-man satellite. With a spaceship on a three-year trip to Mars or Venus and carrying a crew of three, about 2¾ cwt of faeces would accumulate, or about the weight of two members of the crew.

It should be borne in mind that this 2¾ cwt is present in the ship throughout the voyage—at the launching it is present in the form of an equivalent amount of food, and the human body acts on this to convert it into another form, energy being released in the process.

The composition of the faeces varies, but it can be taken as made up of food degradation products, intestinal secretions, cell debris and bacterial products. The chemical compounds include lipids, proteins, amino acids, peptides, vitamins, carbohydrates, bile pigments, phosphates and other salts. Some of these could be used for human food, but separation from the rest would be difficult.

Furthermore, even if such a recovered "food" could be easily prepared it would disgust most people because of its origin. As no objection is taken to the use of human wastes as fertilizers or as food for fish, the suggestion has therefore been made that in a space vessel they might be used as nutrients for growing plants.

Whether or not this is done, green plants can be used for purifying the cabin atmosphere, since they grow by converting carbon dioxide and water into cellulose, etc., and give off oxygen as a by-product. This process regenerates our atmosphere on the Earth, but the fact that it operates here on a very large scale does not mean that it is easy to make it work in the microworld of the astronaut. The cabin cannot be built as a portable greenhouse—even the portholes depicted in science fiction films are unlikely to be present.

The plant employed will have to be chosen carefully. Obviously, it must not be too large or too delicate, it must thrive under artificial light and grow at all seasons, preferably it should be possible to handle it by hydroponics or biochemical engineering techniques, and it should be edible or capable of conversion into edible food.

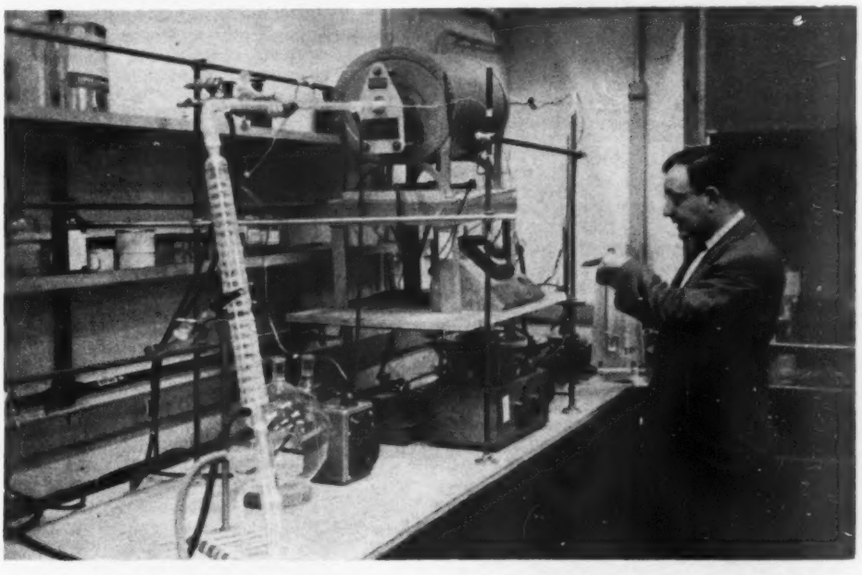
Present research is concentrated upon the algae, water plants high in chlorophyll—the compound which carries out the photosynthesis process. Several organisations are working in this field, and the Bendix Aviation Corporation has already used algae to keep mice alive in a closed cell for three weeks. Work is now proceeding with a man-sustaining system[6].

About 5 lb of algae can produce sufficient oxygen to support one man and to remove his expired oxygen, and this quantity would be dispersed in about 8 cu. ft of water. In producing these results, the algae would itself grow rapidly, and after 24 hours would weight 13 lb. Thus to maintain the initial conditions, 8 lb of algae must be removed each day, and will be available for use as food. During its growth process, the plant can convert the urea and nitrates from the human waste into edible protein; however, some of the faecal constituents are toxic to it, and would have to be separated first.

Apart from this there are other considerations to complicate the picture. The gas exchange process of a plant is not as simple as described above, and a little carbon monoxide is also given off. Over a period of time a toxic concentration could be built up in the cabin (man himself also produces about 10 cu. cm per day), so this must be removed by including a container of Hopcalite in the atmospheric circulation system; this material can catalytically oxidise the carbon monoxide.

The design of a biological system has not proceeded far, and no estimate has been made of equipment needed and its weight. It certainly has no weight advantage over the Martin Company's process for voyages lasting less than 150 days, and possibly this figure is much too small. Added to this, the longer the journey the more the crew will become dissatisfied with a diet of algae, even if it is supplemented by other foods and a wide variety of recipes for cooking the plants has been developed.

The greatest problem to be solved is in fact psychological. The serving of algae at every meal for 2 to 3 years is a dismal prospect—but no doubt one might be conditioned to accept it. After all, the average Englishman eats potatoes day in, day out, from the high chair to the grave. Indeed, if palatable dishes can be prepared from algae for spacemen, there is no reason why the process should not also be used terrestrially to help reducing the world's food shortage. Sewage would be utilised instead of being dumped into rivers, and carbon dioxide could be taken from power station flue gases, as envisaged in E. C. Large's novel.[7]



Using a unique technique called vacuum pyrolytic catalysis, water is being recovered from waste material at the Space Science Laboratory of General Electric's missile and space vehicle department in Philadelphia.

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Disposal of Pickle Liquor

Disposal of waste pickle liquor is a major problem in the steel industry. Methods of disposal and utilisation have been proposed but few are in use.

by W. Bullough, B.Sc., A.R.I.C.
British Iron and Steel Research Association

SINCE the introduction of the River Pollution Bill, considerable attention has been paid to the more economic methods of disposal of waste sulphuric acid pickle liquor.

Such liquors, containing unused acid and ferrous sulphate, can be disposed of thus.

1. Neutralisation of the unused acid and precipitation of the iron with alkali and disposal or utilisation of the resulting sludge.
2. Extraction and disposal of the ferrous sulphate and re-using the recovered acid.
3. Direct recovery whereby the ferrous sulphate is converted into acid without separation.

Neutralisation of the unused acid only with limestone and other relatively inactive alkalis is insufficient since the ferrous sulphate still causes pollution. To precipitate the ferrous ion, it is necessary to use a more expensive alkali, such as slaked lime. The resulting sludge of calcium sulphate and ferrous sulphate is allowed to settle and the supernatant liquor discharged to the drain, and the concentrated sludge to waste land. This method of disposal, however, is expensive, unused acid and alkali being wasted.

EXTRACTION

Since in most cases, neutralisation is uneconomic, it is desirable to extract and filter the ferrous sulphate from the liquor and return the mother liquor containing the valuable unused acid back to the pickle tanks, with an addition of fresh acid equivalent to the ferrous sulphate extracted. Extraction as the heptahydrate, or copperas, can be effected by: (1) Cooling the liquor to low temperatures with heat exchangers; (2) cooling with air, when owing to the evaporation a further quantity of copperas is extracted, and (3) vacuum evaporation and crystallisation.

As the mother liquor is returned to the pickle tanks, a closed system is introduced into which acid is added and from which ferrous sulphate is extracted. It is important, therefore, that the water added to the system in the form of live steam condensate, etc., should be removed as fast as it is introduced. If the water extracted during copperas removal is less than this, then the liquor must be pre-evaporated to make up the difference.

Since the unused acid is returned to the pickle tanks, it is no longer necessary to work the pickle down to a low acidity to economise in acid consumption. Thus the acidity of the pickle and the pickling rate can be increased.

Although the free acid can be recovered, the copperas has to be disposed of in some way. It cannot be dumped as it would still cause pollution and, unfortunately, the market for it is limited. Small amounts are, and can be, used for the following purposes:

1. Manufacture of rouge by roasting.
2. Weedkillers and agricultural sprays.
3. Making chlorinated copperas for water treatment.
4. Treating electroplating wastes containing cyanide. Addition of ferrous sulphate and lime precipitates harmless complex cyanides.
5. Treating chromic acid wastes. The ferrous sulphate reduces the acid to chromic salts which can be precipitated as hydroxide.
6. It has been shown that ferrous sulphate can replace gypsum as an agent for controlling the setting time of concrete.[1] Large quantities of copperas could be used in this way.

It would appear that the most sensible way of disposing of the large amounts of ferrous sulphate produced, would be to roast it to iron oxide and sulphur dioxide returning the iron oxide to the blast furnace and converting the SO_2 to acid for return to the pickle tanks.

Since ferrous sulphate monohydrate is more suitable than copperas for roasting purposes, attention has been paid in recent years to the direct extraction of monohydrate from waste pickle liquor. This method of extraction is particularly useful for continuous strip pickling lines for two other reasons. These are (1) the recovered liquor has a high activity, which is so necessary for the fast pickling speeds, and (2) the large amount of steam condensate in the pickle tanks is removed from the system.

Extraction is effected by evaporating the liquor to high acid strength when the majority of the ferrous sulphate precipitates out in the form of very fine crystals of monohydrate. Acid equivalent to the monohydrate removed can be added to the system before or after the monohydrate removal, but if strong acid is used it is preferable to add it before, since the fuel costs are about 10 per cent lower.

In the Nordac method of recovery oil or gas is burned in a burner, the bottom of which is submerged in 50 per cent w/w acid. The waste gases and steam pass through pipes over which circulates the waste pickle liquor. Thus the liquor is pre-evaporated with the steam in the waste gases, from the burner. The pre-evaporated liquor with sufficient make-up acid is fed into the burner vessel to maintain the acidity at 50 per cent. The precipitated monohydrate is removed with some acid to a separator, where the monohydrate is allowed to cool and settle. A certain amount of the clear supernatant acid equivalent to the recovered acid and the make-up acid is delivered to the store tank, the rest being allowed to return to the burner vessel.

The thick slurry of monohydrate and acid is withdrawn from the bottom of the separator, filtered on a centrifuge and the filtrate returned to the burner vessel. If the monohydrate is sprayed with a little water just before it leaves the centrifuge, the acidity can be reduced to less than 2·5 per cent, when the final product contains approximately 79 per cent $FeSO_4$ and is fairly free flowing. It has been estimated that the cost of operating the plant is more or less balanced by the value of the acid recovered.

In the Zahn recovery method,[2] the waste liquor is sprayed into a large chamber and evaporated to 20 to 30 per cent acid strength with gases at 300° C produced by mixing air with burnt fuel oil or gas. The gases leave the chamber at 70° C and the concentrated liquor is withdrawn. Make-up acid is added to increase the acidity to 40 per cent and precipitate monohydrate which is separated on a suction filter giving a product containing 7·8 per cent H_2SO_4, 72 per cent $FeSO_4$.

There now remains the problems of converting the monohydrate to acid. Several processes have been proposed, and plants have been operated. The Chemical Construction Corporation, for example, mixed the monohydrate with 12 per cent of its weight of coal and sinter fires and pelletised the mixture by passing it through a pug mill and an extruder. The pellets were heated on a Dwight-Lloyd sintering machine giving sintered iron oxide and a gas containing 7·5 per cent SO_2. The gas was scrubbed, filtered, dried and converted to acid in a standard contact plant.

In the above type of plant, monohydrate and coal have to be handled, roasted and the residue handled again. Consequently the plant is complicated and expensive and uneconomical to run on the relatively small output of monohydrate from a medium sized steelworks. Since the acid manufacturers were reluctant to process the monohydrate themselves, and since there would be the cost of transporting the monohydrate to and acid and iron oxide from the plant, the British Iron and Steel Research Association in conjunction with Simon-Carves Limited investigated a process on a pilot scale, which it was hoped would cheapen the conversion of sulphur dioxide to acid, and be suitable for operation on the steelworks site.[4] In this process, known as the autoxication process, monohydrate produced by the Nordac method was mixed with 2 per cent of its weight of coal and fed into an indirectly heated rotating retort. The iron oxide was withdrawn from the end of the retort and the gas cooled and cleaned. The wet gas was absorbed in dilute sulphuric acid containing a trace of manganese sulphate, and allowed to flow into an autoxidation tank, where it was aerated. The oxygen in the air bubbles dissolved in the acid and reacted with the sulphur dioxide and water forming more acid—the reaction being catalysed by the manganese ion. The stronger and sulphur dioxide-free acid was returned to the absorber and when the acidity reached about 30 per cent w/w, more water and catalyst were added to maintain this acidity. At acid strengths greater than 23 per cent it was necessary to protect the catalyst from possible poisoning by introducing a trace of ozone into the air supply. An economic assessment of the process showed it to be economic on a scale as low as 8 tons acid per day. Recently, however, an acid manufacturer has arranged to take the monohydrate from several acid recovery plants and convert it to acid with the contact process.

DIRECT RECOVERY

Besides the above method other more direct methods of complete recovery have been proposed and investigated. These are the electrolytic method and hydrogen chloride method.

In the continuous electrolytic process as proposed by Horner,[3] the electrolytic cell is divided into three compartments by means of two anion exchange membranes with the anode and cathode in the first and third compartments. Waste liquor containing 4 per cent H_2SO_4, 15 per cent $FeSO_4$ flows through the cathode compartment where hydrogen is evolved, iron deposited, and the sulphate ions pass through the anion exchange membrane. Then the liquor flows through the second and finally through the anode compartment and emerges as recovered liquor containing 14 per cent H_2SO_4, 3 per cent $Fe_2(SO_4)_3$. Sulphate ions are discharged at the anode giving acid and oxygen and the cell is operated at 70° C, with 6·5 volts and a current density of 60 amps per sq. ft.

Although the acidity of the recovered liquor is high enough for many pickling processes, the ferric sulphate is undesirable since the ferric ion increases the attack of the base metal during pickling. Moreover, both acid and ferrous sulphates are electrolysed and so it is desirable to work the pickle down to a low acidity.

In the hydrogen chloride method[5] the waste liquor is evaporated to 50 per cent acid strength and hydrogen chloride gas is passed into the resulting slurry of acid and monohydrate to precipitate the iron as ferrous chloride crystals. The crystals are centrifuged and roasted in the presence of steam and air to give iron oxide and hydrogen chloride. The mother liquor containing all the sulphate as sulphuric acid is acid is stripped free from hydrogen chloride and returned to the pickle tanks. The hydrogen chloride is then recycled.

The process has been operated on a pilot scale, but has not yet been adopted commercially.

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Dustless Refuse Collection Comes to Stay

Efforts by British manufacturers to improve existing methods of collecting trade and household refuse in this country are succeeding and a number of suitable vehicles are now available here.

By Alan E. Barton, F.Inst.P.C.

General Manager, Birmingham Salvage Department

SEARCHES for some means of improving the ordinary English system of refuse collection have been going on for some years. In the mid-1950's, certain firms went hundreds of miles abroad in their endeavours to obtain a suitable type of vehicle.

From Germany, the Eagle Engineering Company Limited, Saltisford, Warwick, introduced the Kuka type of body and, from the same country, Glover, Webb and Liversidge Limited, Bermondsey, London, SE1, adopted the Haller body, both using the Zoller pneumatic lifting apparatus. These two systems are now manufactured in this country and fitted to English chassis.

Perhaps the International Conference on Public Cleansing in Frankfurt, during 1957, spurred on the interest in improved methods of refuse collection, and certainly, since those days, many manufacturers have, and still are, evolving their own systems of dustless refuse collection. It is right to add that Shefflex Limited, Sheffield, had supplied their dustless loader to the City of Sheffield for some years prior to this date. Dennis Brothers Limited, Guildford, who have developed the Oschner system of collection, must also be mentioned, as well as the Y.E.W.Co's systems and choice is now available from five systems of dustless collection for the municipalities of this country. It is also understood that it will not be very long before another one is forthcoming.

BIRMINGHAM'S SYSTEM

All this goes to show that the picture of refuse collection in Britain is rapidly changing and, as this dustless system is so much cleaner, so the appearance of the English refuse collector is going to change also. The public cleansing service will only enhance its own reputation by this forward thinking and forward acting.

The City of Birmingham Salvage Department has gone ahead very quickly indeed and is doing away, over a ten-year period, with its present skip system of collection. Kuka bodies (now renamed CleanloaD) by Eagle Engineering, together with Haller vehicles, make up the Birmingham dustless refuse collection fleet. At the present time, 17 vehicles are in use and the department is awaiting the delivery of 17 more. A population of some 35,000 persons are already benefiting from this improved service.

In a world of mechanisation, Birmingham has mechanised the system of refuse collection as much as possible. Dustbins are wheeled out on trolleys from the houses and placed on the pavement for the vehicle. The bins are then fixed to the raising attachment of the Zoller lifting system and, upon an attendant starting the pneumatic apparatus, they are mechanically reversed, emptied and placed back on the roadway. Attendants return them to the pavement and finally wheel them back, by trolley, to their original positions by their respective houses.

The vehicle itself, a cutaway view of which is shown in Fig. 1 on this page, is fully enclosed, the refuse being carried forward from the Zoller shutter by the action of a rotating-paddle section into a rotating body fitted internally with spiral metal fins, and so, to some degree, the refuse is compressed within the vehicle. In the case of the Haller vehicle, a raised screw acts as a trimmer and packer, again receiving the refuse from a rotating paddle system situated between the Zoller apparatus and the main body. The Birmingham system provides for refuse to be discharged at tips and at separation and incineration plants. In Fig. 2,a Haller vehicle is shown discharging its load at a tip.

MANY ADVANTAGES

Is this system quicker or slower than the usual one in this country? As far as the vehicle is concerned, the system is very much quicker. In fact, if it is wished to keep up with the vehicle, it is necessary to maintain a good walking pace, because the time spent by the vehicle at rest is very little indeed; it is quickly on to the next point. So far as the ratepayer is concerned, the vehicle is outside his house a much shorter time than is usual with the ordinary English side or rear-loading vehicle.

It may be asked whether there are any risks in putting this system into use. With a properly organised service, no more risk is encountered than with a simple side-loading system. This type of body and bin-lifting apparatus has long been tested on the Continent and has reached a very high level of performance. Birmingham can claim to have as much knowledge, if not more, of these machines than any other city in this country. They have now been at work in the city for more than 20 months and have settled down extremely well. All teething troubles have long since disappeared and the Zoller system itself has not given any trouble at all. It is difficult to understand why people should fear that there should be trouble because, after all, the system is not new.

From a practical-use point of view, the Birmingham bins show no damage at all and it would surely be a very brave public cleansing officer who would say that, after nearly two years of wear, the average English dustbin bears much relation to its original appearance—unless it has been in the hands of an extremely careful ratepayer. If the bin is emptied manually it is almost impossible to avoid some form of damage to it as the months roll by. The Birmingham bin, manufactured by the Butterfield Organisation, is very strong and has a hinged lid, thereby keeping refuse dry.

Fig. 2 Haller vehicle discharging its load at a refuse tip.

The Birmingham bins were designed by the Salvage Department, in conjunction with two of the leading dustbin manufacturers in the country; briefly, they comprise the 2½ cu. ft British Standard body and base, fitted with the Continental fitments at the top to correspond with the pneumatic shutter system.

In the writer's opinion, costs must be related to efficiency and to the type of service for which local authorities and ratepayers are prepared to pay. As with all things, if the best is wanted, it obviously costs more than the cheapest and the nastiest. The dustless system of refuse collection, with its hinged-lid dustbin, totally-enclosed collecting vehicle, and mechanical-lifting apparatus, offers, of course, the very best; not only to the ratepayers but also to the employees in the refuse-collecting section of the public-cleansing service. Consider the condition of the attendants: one after a day on the dustless system of refuse collection; the other after a normal day with one of the ordinary English systems. The answer is obvious.

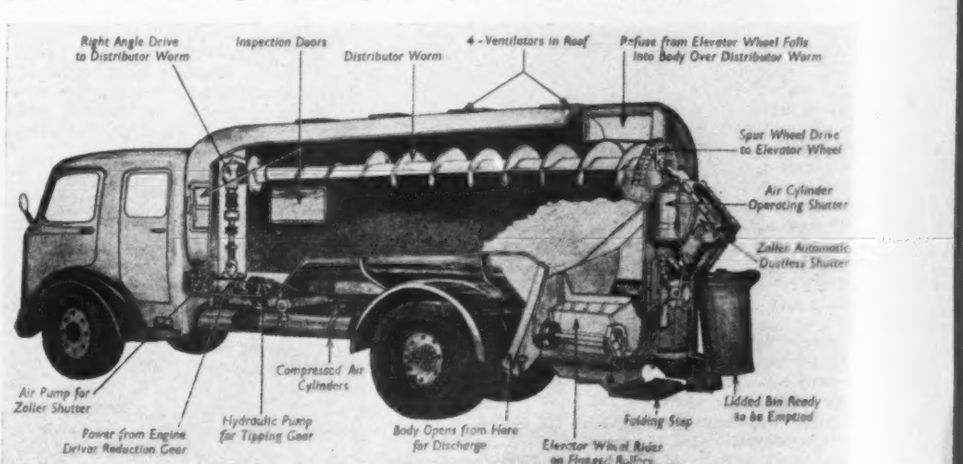

Right Angle Drive to Distributor Worm
Inspection Doors
Distributor Worm
4 - Ventilators in Roof
Refuse from Elevator Wheel Falls into Body Over Distributor Worm
Spur Wheel Drive to Elevator Wheel
Air Cylinder Operating Shutter
Zoller Automatic Dustless Shutter
Air Pump for Zoller Shutter
Power from Engine Drive: Reduction Gear
Hydraulic Pump for Tipping Gear
Compressed Air Cylinders
Body Opens from Here for Discharge
Elevator Wheel Rides on Flanged Rollers
Folding Step
Lidded Bin Ready to be Emptied

Fig. 1 Cut-away view of the Haller refuse-collecting vehicle. This is a 14/28 cu. yd model mounted on a Karrier heavy-duty chassis.

The author of the article "Air Compressor Which Releases No Oil" (ENGNG., 5 Aug. '60, p. 194) has pointed out that the title which we gave the article was not strictly correct, as the design does not completely eliminate oil contamination but reduces it to 0·03 p.p.m. by volume. The h in Fig. 1 and in the ninth line of the "Conclusions" should read h_1 and h_1^a, respectively.

One Hundred Ton Travelling Monotower Crane

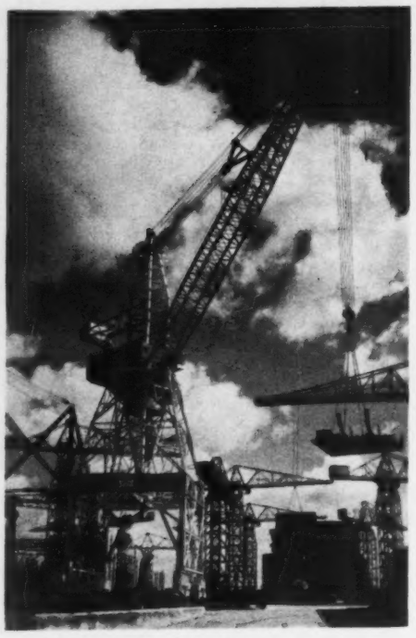
THE modernisation programme at the Birkenhead yards of Cammell Laird and Company Limited has brought with it the requirement to transfer heavy welded prefabricated sections from welding bays under cover to the slipway. A number of travelling cranes have been ordered for this work and the latest to be put into commission is a monotower type reputed to be the largest in the world. It lifts a maximum rated load of 100 tons at a radius of 122 ft. Butters Brothers and Company Limited, Glasgow, designed and constructed it. The 175 ft long jib is made up of riveted aluminium alloy sections. The remainder of the crane is of steel, both welding and riveting being used.

The crane stands on rail tracks at 55 ft centres and is carried by 32 centre-flange wheels. The lower part of the travelling tower forms a portal opening 48 ft high and 49 ft wide, which gives it a free passage to the building berths situated at 50 ft below rail level.

The deadweight of the revolving structure, 580 tons, is carried on a spherical roller bearing at the base of the mast. A 55 b.h.p. motor running at 720 r.p.m. slews the structure, driving through a flexible coupling to a single-reduction spur gearbox. From the spur box, double output shafts drive twin sets of worm and spur gears to the final drive shafts of the motion. These each carry slew-race spur pinions that mesh with the main race wheel bolted to the top of the travelling tower structure. Twelve segments bolted together make up the race wheel, which is nearly 32 ft in diameter, and its inner face forms the path for the horizontal slew rollers that transmit the other horizontal reaction. The slew race is fitted just below the machinery frame, and eight rollers, four on the back and four on the front of the mast, are fitted in pairs on compensating beams to transmit the load equally. Four other rollers are fitted in pairs on either side of the mast to give lateral stability, the whole system forming a large radial bearing.

A slip friction clutch drive is fitted in each of the twin worm boxes, to counteract the effect of sudden stoppages of the slewing motion. Cone type clutches on which a predetermined load is applied by means of helical compression springs are used, the load being adjusted by nuts on the top of the worm box output shafts. These are adjusted to transmit the full torque required to slew the crane. Should this torque be exceeded by the momentum of the rotating parts, the clutches will slip.

The crane operates on an electrical supply of 440V, three phase, 50 c/s, and all motors are of the totally enclosed, slip ring, reversing type. They are all half-hour rated, except for the main hoist motor, which is hour rated. Each motor



is capable of a starting torque twice full load torque, with a starting current of 2½ times full-load current.

The 100 ton load is lifted on a triple pulley block at 10 ft per min by the main hoist motion, incorporating a 115 h.p. motor. With the exception of the barrel spur wheel and its engaging pinion, the spur gearing of the hoist mechanism runs in an oil bath. An electro-mechanical brake is fitted to the motor extension shaft to control the loaded motion and an additional spring-loaded air-release disc brake is included in the motion of the barrel pinion shaft. The latter brake is spring loaded to be continually in the "holding" position and is released by air through an airflow regulator valve in the operator's cabin. Electrical counter current lowering is also included. The auxiliary hoist motion located within the mast frame is driven by a separate 95 b.h.p. motor and lifts loads of up to 10 tons at 90 ft per minute.

The jib is supported at its outer end by a multiple rope reefing. The bridle rope, which is reefed in four parts between the jib and the bridle frame, passes round compensating pulleys to equalise the loads on the four parts of the rope. In addition, the bridle frame carries the reefing pulleys through which the luffing rope, in eight parts, is reefed. The main hoist rope is reefed from the hoist barrel to the mast top and thence to the jib point. On passing over the jib point it is reefed through the three pulleys on the main hoist return block, forming a six part reefing system. The main crane hook is of the Flemish Eye type.

The return part of the main hoist rope is reefed between the jib point and mast top before passing over the Wylie indicator and down the mast to the levelling barrel, which gears with the luffing barrel through a spur drive. This gives the load a horizontal path when luffing.

Four synchronised motors provide the travelling motion, one motor being located in each driving bogie at the four corners of the crane. Four wheels at each corner are driven by means of worm and spur gears from the motor. A flexible coupling is fitted to the motor extension shafts and two of the couplings carry a large diameter brake wheel acted on by an electro-magnetic brake. A time lag is arranged to intervene between the putting off of the motor controller and the coming on of the brake. This prevents undue shocks being inflicted on the structure.

The crane carries 540 ft of four-core flexible trailing cable fed from the centre of the track. On one side of the portal frame is a cable reeling drum incorporating four phosphor-bronze slip rings. Three sets of carbon brushes are insulated to take off the three-phase power and the fourth is uninsulated, being used for earthing. A totally enclosed slip-ring collector column is fitted above the bottom gudgeon pin at the mast bottom.

Semi-Trailer With Automatic Rear Steering

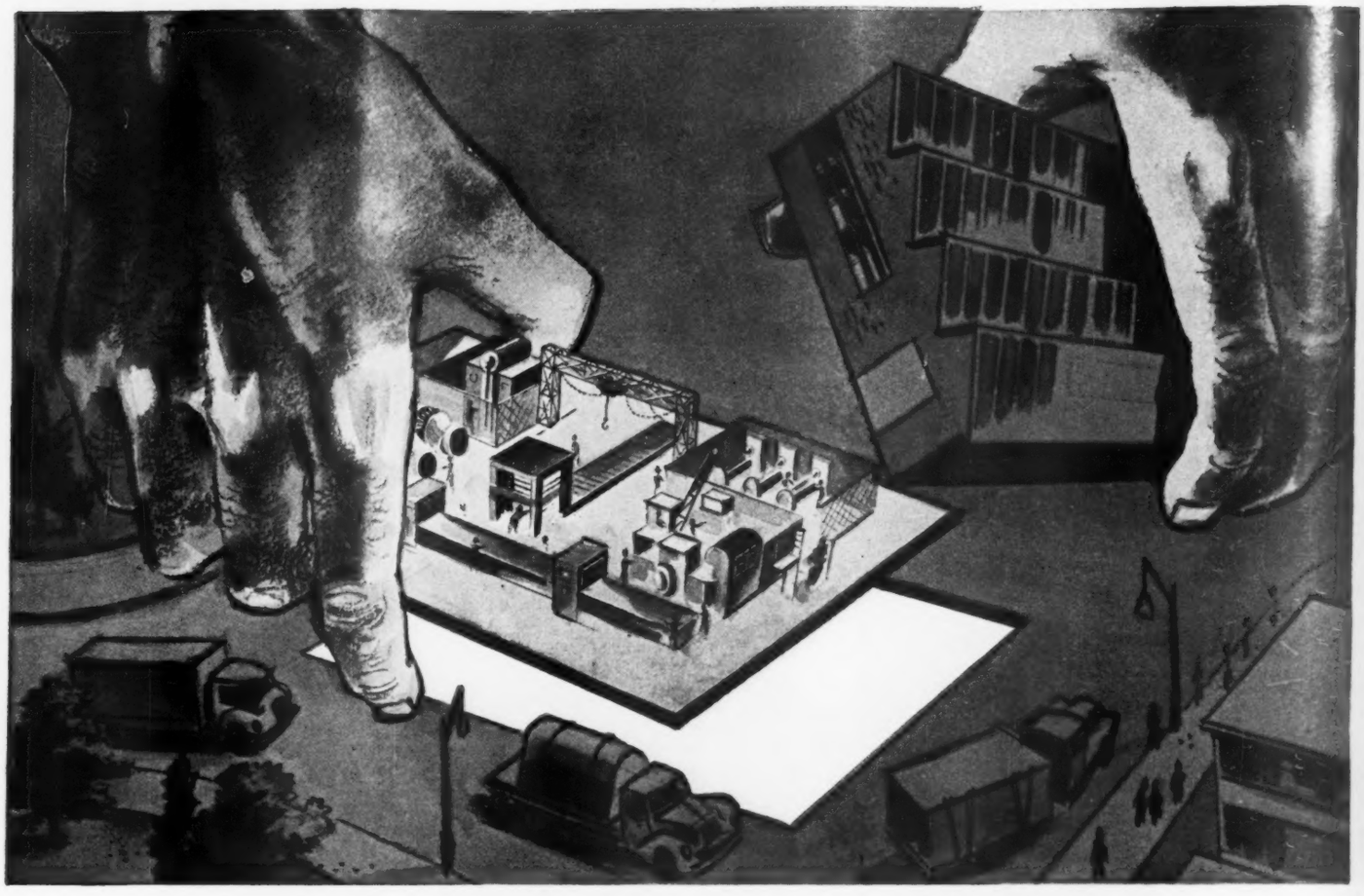
The PV semi-trailer, so designed that the rear wheels are automatically steered by the turning movement of the prime mover, is being produced in this country. The rear wheels are so regulated that they follow precisely in the tracks of the prime mover at all angles of turn. This feature is extremely beneficial for manoeuvring or negotiating narrow winding roads, since there is no tendency for the rear wheels to try to cut the corner. Restricted entrances off private roads, for example, can be entered in one sweep without mounting the kerb or without having to reverse.

Other advantages are the reduction of steering effort on the part of the driver, reduced tractive drag and improved tyre life. Also, no special fittings are required on the prime mover, the steering action being initiated by the coupling which accepts the standard SAE-SMMT fifth wheel pin. No additional action on the part of the driver is necessary.

The four rear wheels of the PV semi-trailer are arranged in line with equal spacing. Offside and nearside pairs each form a separate carriage with a turntable mounting. Steering is effected by means of the semi-trailer kingpin, and a spring-loaded taper block which engages with the V-opening of the prime mover fifth wheel coupling. Angular movement resulting from the articulation between prime mover and semi-trailer operates a simple slotted bell crank mechanism, from which connecting rods transmit the movement to the turntable of the nearside wheel assembly. A track rod connects the offside with the nearside so that both turn in unison.

The PV rear-steering semi-trailer is made by Taskers of Andover (1932) Limited, Waterloo Iron works, Andover, Hants. It has a 12 ton payload, and is only slightly heavier than a comparable non-steering trailer, weighing less than 3½ tons in the form shown in the illustration.

The PV semi-trailer negotiating a sharp left-hand bend. The coordinated turning action of the two rear carriages is clearly visible.



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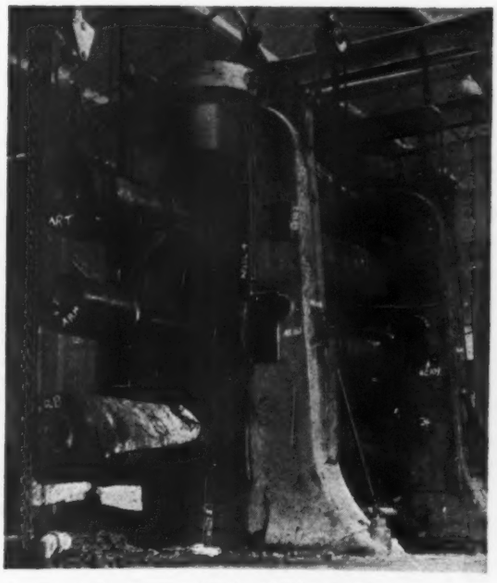

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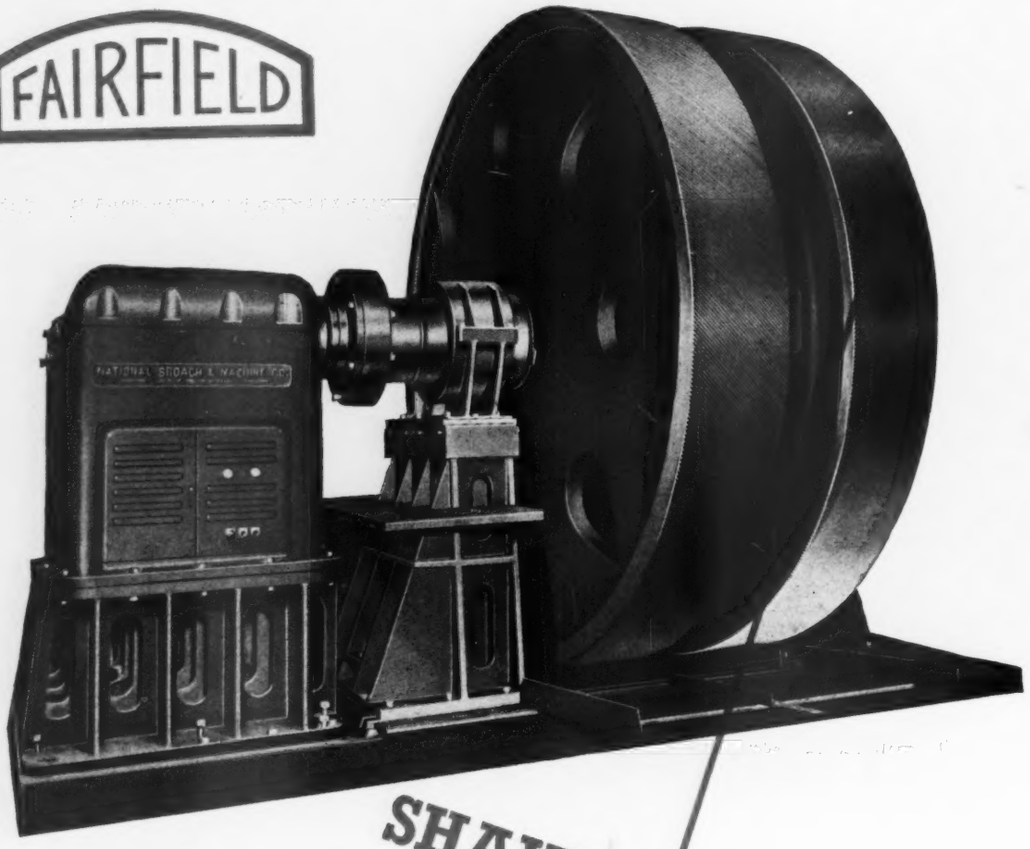

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Marketing

Decline and Fall of the Price Level

SINCE the war, and in many periods before 1940, it has become almost an axiom that prices always rise, and indeed always have done.

Now Dr. R. G. Lipsey, who is Reader in Economics at London University, has taken a dispassionate view of price moves over the centuries and he dispels the view that over any ten year period prices at the end of the decade will be higher than at the start.

Between 1275 and 1949, says Dr. Lipsey writing in the October issue of the Lloyds Bank Review, an estimate that prices would be higher ten years from the date in question would have been correct on 57 occasions in a hundred and wrong on 43.

What Dr. Lipsey's observations principally show is that the obvious inflationover the last seven centuries has been to a great extent due to three main phases of unusually sharp decline in the value of money. The third of these was the Second World War, which took up the first half of the period 1940 to 1952, the longest spell of uninterrupted rising prices in the whole seven centuries.

It is not too easy to be sure that the history of past price movements, the 1316 price peak was not exceeded until 1546, are a reliable guide to what the future trends will be. None of the centuries considered held anything like the present rapid increase in industrialisation, or technical advance in agriculture or in speed of transport, not only of people but of cargoes. Under these influences the supply of money may not conform to the pattern of less swiftly changing times.

Further Impact of the Compacts

The United States' compact cars have dented more sales than those of foreign cars and the middle ranges of Detroit models.

They have produced a measurable effect on the home consumption of petrol in North America. It is not a cut in sales that is causing concern but a reduction in the rate of growth, because some ambitious future programmes are geared to taxation from motor fuels and those taxes may not be forthcoming in full.

Federal and state taxes on petrol now account for half its retail cost. For spending on the sort of scale laid down on the 41,000 miles of new limited access roads planned for the years up to 1972, it is a black outlook that compact cars, with their sharply falling petrol appetites, already account for 25 per cent of sales and by 1964 will probably account for 50 per cent. Against this sort of decline it is not surprising that there is so much enthusiasm in differing quarters for the adoption much more widely in America of the two-car family habit.

The way tax returns are coming in now in both states and cities suggests that the estimates will be sufficiently fallen short of for serious difficulties to arise in keeping up with the road programme on a pay-as-you-build basis. One estimate is that within four years petrol tax revenues will be $500 million behind the present estimates.

Raising the taxes is not likely to help much. Since so doing would be more likely to reduce the amount of motoring, or to increase the number of compacts, or both.

What remains is the possibility that the United States authorities may change the present system by which cars pay registration fees according to weight.

At present it seems unlikely that the American pattern of private wealth and public squalor will be allowed to spread to the roads.

Fuel Advice To Cost More

Advice and technical assistance on fuel problems given by the NATIONAL INDUSTRIAL FUEL EFFICIENCY SERVICE is going to cost more.

The service, which has a growing reputation for valuable guidance to industry, was last year making charges which were only 62 per cent of costs. This year the charges have been brought up to 70 per cent. It is intended that eventually the fees should cover the cost of the service provided.

NIFES spends another £250,000 on activities, described by the chairman, Sir Leslie Hollingshurst, as "good works" and this is not to be recovered in the charges.

There is a situation of complex irony in the relations between the NATIONAL COAL BOARD and the Service. For coal to maintain its place in the battle with oil it has to be burnt with greater efficiency and the advice from NIFES has led to a reduction in coal consumption by 8,500,000 tons between 1955 and 1958. It is right to bear in mind that the plants using less coal more economically may well expand their output and in time their coal consumption. If they had gone over to oil both the present market and the future prospects would have been lost to the Coal Board. The Board provided £291,000 towards NIFES costs in the last financial year. The other contributors, gas, electricity, two oil companies and the Northern Ireland Government all made smaller contributions.

Recovery in Canadian Exports

In the first eight months of the year the Canadian trade deficit is only a little more than a third above the total shortfall for the same months of last year. In August the dominion's exports produced a surplus of $11 million, the third month to show a trading "profit" during the year.

It is one of the wry facts of current international trade that much of the Canadian improved performance has been built up through trade with Britain, whose own export position shows no equivalent signs of wellbeing.

Canada's surplus from trade with the United Kingdom in August rose to $25 million, compared with $12 million in August twelve months earlier. Exports to Britain were worth $77 million during the month, against $68 million. British exports to Canada had declined to $52 million from $56 million.

The recovery in Canada's external trading position continues despite a high level of unemployment and sluggish conditions in parts of the country's economy.

Beagle Takes Off

Close on the announcement of its provision of bodies for the new small car to be built by Rootes alongside the Linwood, Scotland, plant of PRESSED STEEL, follows the announcement that the company is to build light aircraft.

The Pressed Steel Company's interests will now cover car bodies, refrigerators, railway stock and now light and executive type aircraft.

The new move is along two main lines. A new subsidiary is being formed. To be known as "Beagle," this company will be BRITISH EXECUTIVE AND GENERAL AVIATION and it will design and produce light and executive aircraft for the home and overseas markets.

The entire issued capital of AUSTER AIRCRAFT, the private light aircraft company who produced the famous spotter plane, is to be bought by an issue of Pressed Steel Ordinary stock and cash. The company will carry on.

Pressed Steel, who have their own airfield at Kidlington, outside Oxford, are ardent exponents in their own management practice of the application of flying to executive travel.

A key element in the new venture is the appointment of the former BRITISH EUROPEAN AIRWAYS' chief executive, Mr. Peter Masefield, to be managing director of Beagle, chairman of Auster, chairman of Pressed Steel's coordinating board for aviation activities within the group, and a member of the Pressed Steel board. A former managing director of Bristol Aircraft, and a leading thinker on the future of civil aviation, Mr. Masefield may be the man, with Pressed Steel's expansive zeal behind him, to catch up the Americans and the Italians who have gone so far ahead of Britain in the manufacture of the personal and business aircraft. The company look forward not least to selling in the established United States market.

Mr. Masefield's undoubted flair for publicity will be an added asset to the new arrangements. He has himself been for some time working on the design of a new light aircraft.

On the manufacturing side a technical and manufacture liason agreement has been reached with F. G. MILES, of Shoreham Airport. ROLLS-ROYCE are taking part in talks that it is hoped will lead to the company producing a fresh light aircraft series of engines.

If those in need of faster travel are not able to rise above the traffic jams—in Pressed Steel bodies lifted by Rolls-Royce engines—it will be no fault of Peter Masefield.

US Government Closes Cuban Nickel Plant

After a lull in the announcements from Cuba to requisitioning and confiscation of foreign owned firms comes the decision by the United States authorities to shut down the American owned nickel processing plant in Cuba.

The reason given by the US State Department is that the plant has suffered harassment from the Cuban Government and has had "confiscatory taxes" imposed upon it. On the first of this month the Cuban Government announced that all nickel shipped from the country would have to have had taxes paid.

The plant concerned, the Nicaro works, employed, directly or indirectly, some 2,800 people.

A Halt in the Indian Trade Decline?

Most recent figures for the fall in the Indian sterling balances suggest that while the decline continues the worst of the fall is now past.

In the six weeks up to 23 September, India's sterling balances fell by 10 million rupees to 1,430 million (about £107,250,000). This is a much smaller fall over the period than has been going on.

But official steps have still just been announced to tighten up the import restrictions and save about 30 million rupees (£2,250,000). Since it is necessary to do as little as possible that will damage the development plans the quotas in which reductions have been announced are those for consumer goods such as whisky, cotton fabrics and also for plate and sheet glass. In another group, including watches, photographic materials and tractors (in which DAVID BROWN have an interest) no decision is being made until the Minister of Finance, Mr. Morarji Desai, has returned from his world tour.

Farm Machinery Exports Still Rising

Farm machinery exports from Britain in the first two thirds of the year are 13½ per cent greater than in the same months of last year. Announcing this the AGRICULTURAL ENGINEERS ASSOCIATION described the figures as a record. Tractor exports are 35 per cent better. A particularly useful field has been the European Common Market where exports had improved by 35 per cent. The overall export increase is worth more than £20 million.

Detergent Plant Order for New Russian Factories

TECHMASHIMPORT, the Soviet importing agency, have ordered equipment worth almost £3 million from two British companies.

The plant for two factories to produce the raw materials for detergents is to be supplied by MARCHON, an ALBRIGHT AND WILSON subsidiary. The equipment by CONSTRUCTORS JOHN BROWN.

Anglo-American Aromatics Arrangement

The BRITISH PETROLEUM Company are to take part in a £7 million European scheme with the CALIFORNIA CHEMICAL Company. Two aromatics plants are to be constructed, one adjacent to BP refineries on the Isle of Grain, Kent, and the other at Dinslaken, in West Germany.

The new concern is to be known as BP CALIFORNIA. BP will operate the plants. The first production from the plants is due next year. Orthoxylene, ethyl benzene and paraxylene the base for polyester fibres will be produced at the plants.

Negotiations are going on with BADGER, BECHTEL and WIMPEY for the construction of the Isle of Grain plant.

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It is significant that, apart from distinguished foreign contributors, the authors are fairly equally distributed between university and research organisations, local authorities and industry. The representation might, however, have been even better if there had been more than one contribution from river boards, since rivers are the eventual recipients of most waste waters and are also important sources of supply for both potable and industrial purposes.

The majority of the papers cover two very important aspects of the general problem, those of the theory and mechanics of biological treatment and the handling and removal of residual solids. It is encouraging to see both aerobic and anaerobic biological methods of treatment considered from a biochemical point of view for these are fermentation processes which in the past have largely been subject to microbiological study. It is seldom appreciated that there is more capital invested in sewage treatment plant than in any fermentation industry. The efficient design of treatment plant can only be successful if it is based, among other considerations, on a very complete understanding of the biological oxidation or degradation of organic matter. Similarly, the importance of analysis is stressed not only as a measure of the treatment required and subsequently what has been accomplished, but also as a source of information for plant design and materials of construction.

The difficulties associated with the dewatering and disposal of sludges are well known but progress is clearly being made as the result of basic work on the physical characteristics and behaviour of these materials and the effects of bacterial action. A number of individual trade-waste problems are discussed and the methods of treatment described. These serve to show how theories are put into practice, and the value of research. It would, however, be most interesting if an economic study were made of such methods, since industry, no less than local authorities, should be able to assess the cost of their obligations, and improvements in the condition of our rivers will involve very heavy capital expenditure.

It is evident that water supply and the purification of wastes are part of a single problem which is of immense importance in a highly industrialised and densely populated country. Years of neglect have allowed a number of our rivers to become polluted and large volumes of waste are discharged without treatment. The remedy lies in the hands of river boards, local authorities, industry and water undertakers—but collectively and not as individuals. In the past unilateral action has been signally unsuccessful. Constant research and development allied with close and understanding cooperation are required if any significant impression is to be made on what is a national problem.

This book gives a clear indication that progress is being made along these lines.

C. J. JACKSON

Waste Waters Analysed by Standard Rules?

Approved Methods for the Physical and Chemical Examination of Water. 3rd edition. *Institution of Water Engineers, Parliament Mansions, Abbey Orchard Street, London, SW1.* (10*s*)

The recent publication of the *Approved Methods* in a third edition gives us an opportunity to remind ourselves how well equipped we are in Britain with manuals of standard analytical methods for water and waste waters. The publication, in 1958, of the *Recommended Methods for the Analysis of Trade Effluents* completed the series. We now have the *Approved Methods* for water, the *Recommended Methods* for industrial waste waters, *Methods of Chemical Analysis as Applied to Sewage and Sewage Effluents*, and the Ministry of Health Report No. 71 for bacteriological examination of water supplies—all well-conceived and excellently produced. And yet outside Britain—and not sufficiently rarely in Britain—these methods are unknown and the *American Standard Methods* (now in its tenth edition) holds sway. Why is this?

There are at least two reasons. The first is that the British seem less aggressive in the "colonialism of ideas" (or trumpet-blowing, if you prefer) and the second is that these manuals come out under so many auspices: ministries, the Society of Analytical Chemistry (representing public analysts), and professional societies and institutions. These bodies, severally and through joint committees, keep under review the analytical methods applicable to their own fields. Certainly we could expect no startling refinement of method if all these manuals were under the aegis of a single responsible body, but I am sure that these analytical techniques would gain wider adoption—with advantage. Is it too much to hope that we can have a single authoritative *British Standard Methods*? Perhaps the Society of Analytical Chemistry, already concerned with two of the existing sets of methods, can take the lead.

No great changes have been made in the content of this edition of *Approved Methods*. The chief revisions are concerned with the determination of nitrate, sulphate, sodium and potassium, aluminium, copper, lead and zinc. The current concern with synthetic detergents is reflected in the inclusion of the method of Longwell and Maniece for the determination of anionic synthetic detergents. Though this is probably the best routine technique available, it is not entirely satisfactory and we must hope that analysts will devise an improved method. The aluminium determination developed by Dr. Packham, of the Water Research Association, using Aluminon has been included. The general trend towards photoelectric instruments for analysis is here demonstrated by the recom-

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Waste Treatment is a sequel to the Proceedings of a Course on the Treatment of Trade Waste Waters and the Prevention of River Pollution held at King's College, Newcastle, in April, 1957. The importance to the country's economy of the prevention of river pollution, recent and pending legislation, and growing popular concern about these matters makes the publication of this book both timely and important. A great deal has been written about this problem and there are several excellent textbooks on the subject which, however, deal more with generalities than with cases. It is therefore certain that this symposium, which gives considerable detail about both theory and practice and contains valuable discussion, will make a wide appeal to all those concerned with the treatment of waste waters.

It is significant that, apart from distinguished foreign contributors, the authors are fairly equally distributed between university and research organisations, local authorities and industry. The representation might, however, have been even better if there had been more than one contribution from river boards, since rivers are the eventual recipients of most waste waters and are also important sources of supply for both potable and industrial purposes.

The majority of the papers cover two very important aspects of the general problem, those of the theory and mechanics of biological treatment and the handling and removal of residual solids. It is encouraging to see both aerobic and anaerobic biological methods of treatment considered from a biochemical point of view for these are fermentation processes which in the past have largely been subject to microbiological study. It is seldom appreciated that there is more capital invested in sewage treatment plant than in any fermentation industry. The efficient design of treatment plant can only be successful if it is based, among other considerations, on a very complete understanding of the biological oxidation or degradation of organic matter. Similarly, the importance of analysis is stressed not only as a measure of the treatment required and subsequently what has been accomplished, but also as a source of information for plant design and materials of construction.

The difficulties associated with the dewatering and disposal of sludges are well known but progress is clearly being made as the result of basic work on the physical characteristics and behaviour of these materials and the effects of bacterial action. A number of individual trade-waste problems are discussed and the methods of treatment described. These serve to show how theories are put into practice, and the value of research. It would, however, be most interesting if an economic study were made of such methods, since industry, no less than local authorities, should be able to assess the cost of their obligations, and improvements in the condition of our rivers will involve very heavy capital expenditure.

It is evident that water supply and the purification of wastes are part of a single problem which is of immense importance in a highly industrialised and densely populated country. Years of neglect have allowed a number of our rivers to become polluted and large volumes of waste are discharged without treatment. The remedy lies in the hands of river boards, local authorities, industry and water undertakers—but collectively and not as individuals. In the past unilateral action has been signally unsuccessful. Constant research and development allied with close and understanding cooperation are required if any significant impression is to be made on what is a national problem.

This book gives a clear indication that progress is being made along these lines.

C. J. JACKSON

Waste Waters Analysed by Standard Rules?

Approved Methods for the Physical and Chemical Examination of Water. 3rd edition. *Institution of Water Engineers, Parliament Mansions, Abbey Orchard Street, London, SW1.* (10*s*)

The recent publication of the *Approved Methods* in a third edition gives us an opportunity to remind ourselves how well equipped we are in Britain with manuals of standard analytical methods for water and waste waters. The publication, in 1958, of the *Recommended Methods for the Analysis of Trade Effluents* completed the series. We now have the *Approved Methods* for water, the *Recommended Methods* for industrial waste waters, *Methods of Chemical Analysis as Applied to Sewage and Sewage Effluents*, and the Ministry of Health Report No. 71 for bacteriological examination of water supplies—all well-conceived and excellently produced. And yet outside Britain—and not sufficiently rarely in Britain—these methods are unknown and the *American Standard Methods* (now in its tenth edition) holds sway. Why is this?

There are at least two reasons. The first is that the British seem less aggressive in the "colonialism of ideas" (or trumpet-blowing, if you prefer) and the second is that these manuals come out under so many auspices: ministries, the Society of Analytical Chemistry (representing public analysts), and professional societies and institutions. These bodies, severally and through joint committees, keep under review the analytical methods applicable to their own fields. Certainly we could expect no startling refinement of method if all these manuals were under the aegis of a single responsible body, but I am sure that these analytical techniques would gain wider adoption—with advantage. Is it too much to hope that we can have a single authoritative *British Standard Methods*? Perhaps the Society of Analytical Chemistry, already concerned with two of the existing sets of methods, can take the lead.

No great changes have been made in the content of this edition of *Approved Methods*. The chief revisions are concerned with the determination of nitrate, sulphate, sodium and potassium, aluminium, copper, lead and zinc. The current concern with synthetic detergents is reflected in the inclusion of the method of Longwell and Maniece for the determination of anionic synthetic detergents. Though this is probably the best routine technique available, it is not entirely satisfactory and we must hope that analysts will devise an improved method. The aluminium determination developed by Dr. Packham, of the Water Research Association, using Aluminon has been included. The general trend towards photoelectric instruments for analysis is here demonstrated by the recom-

mendation of the flame photometer for sodium and potassium, and by the general remarks on spectrophotometers.

In my laboratory we have for some years used the Jackson candle turbidimeter and it is interesting to see that this method is recommended. In addition the interesting work of Knight, Palin and Hoather on measuring colour and turbidity in combination is mentioned; we have used the technique with success.

The *American Standard Methods* adopts the useful idea of including "tentative methods"—methods which seem to show promise, but which have not been used for long enough to be sure that there are no snags. In this category, for example, the American manual includes Palin's neutral *o*-tolidine method for residual chlorine, which is included in the *Approved Methods*. I should also like to have seen included in this category Dr. Palin's latest chlorine titration, in which he uses *p*-aminodiethylaniline sulphate.

Finally, it remains only to welcome this revised edition of *Approved Methods* as an essential guide to all concerned with water analysis and to hope that it will be very widely disseminated and appropriately used. (I remember with dismay the analyst I found about a year ago using the 1949 edition of these methods for the analysis of *sewage effluents*.)

PETER C. G. ISAAC

Treating Metal Surfaces

Handbook on Electroplating, Polishing, Bronzing, Lacquering. 19th Edition. *W. Canning and Company Limited, Great Hampton Street, Birmingham 18.* (30*s*)

There will be many in those industries making use of electroplating who will welcome this new edition of W. Canning and Company's well established handbook. The first to be produced under the guidance of Mr. F. H. Ewens, the present chairman of the company, and under Mr. R. Allen as technical editor, it follows the general lines of other recent editions but aims at including changes and developments in the technique since the 1953 issue.

The book is addressed to foremen platers, to the supervisor, the production manager and all those actively engaged in the finishing of metal articles. As a practical manual and not a textbook, it does not deal in any detail with the theory of the processes it describes, but says enough about the underlying principles to give a fair understanding of the methods used.

As is to be expected, the bulk of the text is concerned with the main subject of electroplating. Under this heading are included cleaning and pickling prior to plating and also the anodic oxidation of aluminium and the production of protective coatings on magnesium. Actual plating techniques are treated in chapters devoted separately to individual metals and to certain special applications of electrodeposition. The various types of solution, their operation and maintenance are described. Each chapter on a particular metal concludes with tables listing the defects liable to occur, their probable cause and methods of correction.

Readers of this journal will no doubt be interested to note that engineering applications such as heavy deposition of nickel, hard chromium plating, stopping-off for case-hardening and so on receive due mention. A new chapter on electrolytic and chemical processes for the polishing and brightening of metals provides a useful account of the possibilities and limitations of these processes and of the methods applied for particular metals and alloys. The post-war tightening of regulations for the disposal of trade effluents and the effect of this on plating establishments has prompted the publishers to include a brief survey of effluent treatment.

For the benefit of those to whom the book is new, it is as well to make clear that it is not simply a handbook in the usual sense of a compact and practical guide but is written in terms of the equipment, materials and processes the publishers have to offer. Presumably on this account and as a matter of policy a number of features that one would expect to find in such a handbook are omitted.

In the present edition for the first time, analytical standards for the principal constituents of Canning's plating solutions are laid down, but a straightforward statement on the make-up of the solutions—which would add so much to an understanding of their working and to their intelligent operation—is lacking. This omission cannot really be explained on grounds of disclosing a trade secret. If the formula for, say, a bright nickel plating solution were revealed, few if any of the company's customers would find it either more economical or more convenient to buy the constituents elsewhere and prepare the mixture for themselves, even supposing they wished to dispense with the technical service normally given free of charge by the company to users of their processes. The company would help themselves and their customers by coming into line in this respect with at least the more up-to-date of their competitors.

Again, with few exceptions, methods for the analysis of solutions are not given, the publishers preferring to draw attention to the services provided by their own laboratories. Even tables showing the relation between density and concentration of certain solutions are not to be found.

Rather more surprisingly, only the briefest mention is made of specifications for electrodeposits, no figures are quoted, and no emphasis is laid on the importance of plating to specification as a means of ensuring the production of plated goods of high quality. Incidentally, the abbreviations used throughout the book are inconsistent and old-fashioned, and the compilers would find it useful to refer to British Standard 1991 : 1954, "Letter Symbols, Signs and Abbreviations."

Quite frequently plant and equipment are indicated simply by what is nothing more than a catalogue illustration, serving to identify the item when seen. An exploded view or a section would enable the reader to understand better the construction and function of the equipment and the prospective purchaser to appreciate its merits. One would also expect to see in a book of this practical kind information and typical calculations on the plating capacity of vats and on plant requirements for a given output.

Despite these few omissions, no other plating supplier offers so comprehensive and useful a volume. The book is printed on good paper, is well bound, and has an adequate index, all features needed in a work to which reference will frequently be made. At its modest price, it can be bought not only as a guide to what W. Canning and Company have available, but also for the sake of the large amount of practical information it contains.

J. M. SPRAGUE

New Books

The Dynamic Behaviour of Thermoelectric Devices. By PAUL E. GRAY. *Technology Press of the Massachusetts Institute of Technology and Wiley, New York and London.* (28*s*)

An investigation of the small-signal dynamic behaviour of thermoelectric heat pumps and generators used as a basis for examination of the validity of the theoretical results.

Fiscal Policy in Underdeveloped Countries, with Special Reference to India. By RAJA J. CHELLIAH. *Allen and Unwin.* (20*s*)

The central theme of this book is the application of recent advances in the theory of fiscal policy to the promotion of economic development, and the demonstration of the differing needs in fiscal policies of advanced and underdeveloped countries.

Eye on Research. By G. RATTRAY TAYLOR. *John Murray.* (16*s*)

Based on a series of television programmes, Mr. Taylor's book aims at presenting a stop-press report on scientific advances to the layman.

Polyester Resins. By JOHN R. LAWRENCE. Reinhold Plastics Applications Series. *Reinhold Publishing Corporation, New York; Chapman and Hall, London.* (46*s*)

From 10 million pounds in 1957 the production of polyester resins is expected to rise to 250 million pounds by 1965. The present book covers chemistry, curing mechanisms, manufacture, processing and applications, and includes a tabulation of the standard resins available.

Trade Publications

Copies of any of the following trade publications are obtainable from the addresses given, though distribution is sometimes restricted.

Plant

Air Filters. VISCO ENGINEERING CO. LTD., Stafford Road, Croydon, Surrey. Oil-wetted air filter type KM gives 98 per cent efficiency in accordance with BS 1701. Square units from 12 in by 12 in to 24 in by 24 in. Folder No. 598 gives details and performance curves.

Electrostatic Precipitators. STURTEVANT ENGINEERING CO. LTD., Southern House, Cannon Street, London, EC4. Examples of electrostatic precipitators given in illustrated folder No. 7020.

Separator. THOMAS ROBINSON & SON LTD., Rochdale. Separator type RZm for cleaning wheat, peas, grasses and other products. Five models either metal or timber framed. Incorporates both vibrations and aspiration methods. Illustrated leaflet 538.

Centrifuge. INTERNATIONAL COMBUSTION PRODUCTS LTD., 19 Woburn Place, London, WC1. The Dynocone solid bowl continuous centrifuge for separating solids from liquid suspensions and for hydraulic classification. The 16 page publication No. G604 gives details and mode of operation.

Ultrasonic Cleaner. DAWE INSTRUMENTS LTD., 99-101 Uxbridge Road, Ealing, London, W5. Soniclean Type 1156 delivers 250 watts peak to a cleaning tank 7 in by 3½ in by 5 in high or to a bulkhead transducer. Leaflet.

The Reviewers

Mr. James C. E. Button, B.Sc., A.Inst.P., was until recently health and safety manager (operations) at the Dounreay Experimental Reactor Establishment, where he was responsible for all safety services, including radiation safety (health physics) and industrial safety. He is at present on leave of absence from the UKAEA having joined the International Atomic Energy Agency as health physics adviser to the Government of Thailand.

Mr. H. J. Dunster, health physics advisor to the Health and Safety Branch in the UKAEA, was the principal British representative at the conference on radioactive waste disposal held in Monaco.

Dr. C. J. Jackson, O.B.E., attended Cambridge, Alberta and Glasgow Universities. He is in charge of trade effluent problems for the Distillers Company Limited, both on the industrial and potable side. He has just completed a four year term of service on the Water Pollution Research Board of DSIR and is chairman of the FBI trade effluent committee.

Mr. Peter C. G. Isaac, B.Sc. (Eng.), S.M., M.I.C.E., M.I.W.E., M.Inst.S.P., F.R.S.H., is senior lecturer in public health engineering at King's College, Newcastle, in the University of Durham. He is the author of *Public Health Engineering* and editor of *The Treatment of Trade-Waste Waters and the Prevention of River Pollution* and *Waste Treatment*.

Mr. John M. Sprague, M.Sc., F.R.I.C., F.I.M., is a consulting electrochemist, specialising in electroplating and related processes.

Getting the Best from Cleansing Vehicles

From the maintenance point of view municipal cleansing vehicles pose many problems inherent in their arduous duties. Increased standardisation both of the vehicles themselves and of maintenance methods may be the answer.

By P. K. Patrick

A PROBLEM arising in most municipal cleansing departments is how to keep a balance between the demands of the operational services and the requirements of the maintenance section. The cleansing services require a wide variety of vehicles—refuse collectors with specialised bodies, gully emptiers, mechanical sweepers, etc., and the provision of spare vehicles in each class may be a heavy financial burden, particularly to small authorities. It is therefore preferable to plan both the operational work and vehicle maintenance to allow for regular servicing. Furthermore, reliability is essential in a public service and this can only be obtained by systematic inspection and repair of vehicles.

Fig. 1 20/30 cu. yd Pendulum tipping body made by John Gibson and Son Limited, Edinburgh 6, on a Leyland Comet chassis. The load is compressed by a 10 ton hydraulic ram, and there are several sizes ranging from 8/12 to 23/35 cu. yd capacity. A bin lifter is also available.

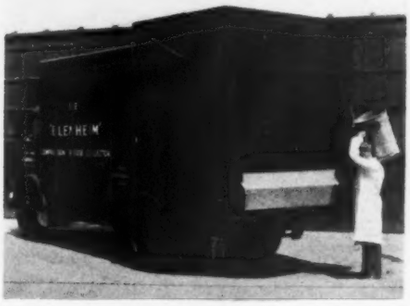


Fig. 2 Blenheim refuse collector tipping body made by Glover, Webb and Liversidge Limited, London, SE1, and only available on Karrier chassis. The load is compressed by two hydraulic rams. Two sizes are available, 11/15 and 22/30 cu. yd.

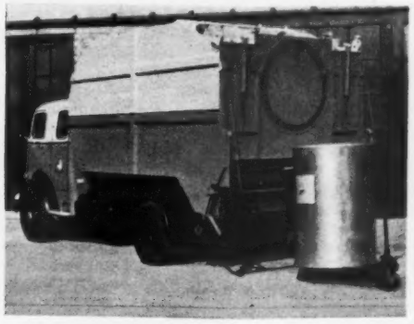


Fig. 3 Glover, Webb and Liversidge Bin Lifter, a special version of the Dual-Tip refuse collector. Low loading height and simplicity of operation are the principle features. Provision can also be made for square or oblong bins.

Inspections are generally scheduled for intervals not exceeding eight weeks, and the mechanic carrying out the work is given a list of items to be checked so that there is no doubt as to the extent of the inspection. Steam cleaning is a desirable preliminary, as cracks, broken spring leaves and the like cannot easily be detected if the vehicle is covered with dirt. Experience with particular types of vehicle will indicate special features requiring examination, but all matters affecting safety, e.g. brakes, steering, wheel nuts and lights, are covered. Spring U-bolts and centre bolts on refuse vehicles require particular attention, as these vehicles are subjected to repeated bumping against tipping beams.

OVERCOMING WEAR

Operating conditions of refuse vehicles are far from ideal from an engineering viewpoint. Long periods of idling, with cold running in winter, can result in severe contamination of sump oil, with detrimental results on bore and crankshaft wear. Diesel engines are particularly liable to rapid cylinder wear arising from low operating temperature, and in cold weather radiator blanking plates are desirable. Chromed cylinder liners or chrome deposit on cylinder bores have proved very successful in combating these adverse operating conditions and are now widely used in cleansing vehicles.

Lubrication, draining of sumps, gearboxes and axles, and changing of fuel and oil filters are best arranged to coincide with routine inspections, to avoid having a vehicle off the road more often than is necessary. Hours of use rather than mileage form a better basis for cleansing vehicle servicing, as mileage generally bears little relation to engine usage. Engine oil must be changed frequently on account of operating conditions and 500 hours is usually regarded as the maximum period between sump oil changes.

It is not necessary to specify intervals for decarbonising; with modern detergent oils cylinder heads need not generally be removed solely to remove carbon, and decarbonising is usually carried out only when attention to valves is needed.

Specialised public cleansing vehicles are expensive in first cost and have a very low residual value. Economic considerations therefore call for a comparatively lengthy service life with consequent need for overhaul at some intermediate period. The condition of the body and ancillary gear will usually be the governing factor in deciding when overhaul is necessary. Refuse collection vehicles generally require extensive repairs to the bodywork, and reconditioning of chassis and transmission, after five or six years' service. Electric wiring is renewed, road springs are re-set and replacement or reconditioning of components carried out as necessary, having regard to the intended life of the vehicle. It is convenient to draw pistons at such overhaul, examine bearings and fit new rings.

The choice of reconditioning or service-exchanging worn assemblies or parts is governed by the extent of workshops staff and equipment available, but for small authorities with only a few vehicles and limited facilities, exchange assemblies are almost essential to enable vehicles to be returned to service with the minimum of delay.

Observation of cleansing fleets in various parts of the country leads to the conclusion that many authorities do not appreciate the economies in maintenance to be derived from standardisation. A completely standardised fleet, even in engines and chassis, is almost unobtainable in practice owing to variations between different series of the same make. Nevertheless, within the limits imposed by continuous technical development and the need for a variety of body types, standardisation is one of the major factors influencing economic and efficient maintenance. The main advantages are self-evident—interchangeability of units and minimum stock-holding of spares—but there are other less obvious benefits which affect maintenance. Not the least is the specialised knowledge which mechanics will acquire. This makes for quick diagnosis of defects and ready interchangeability of mechanics on different vehicles. The cost of special tools is also minimised and difficulties which can arise with regard to lubricating oils in a mixed fleet are avoided.

While there are a few specialist builders of chassis and cabs for cleansing vehicles, in the majority of cases a standard commercial product is used with bodies built by firms who specialise in this field. In the case of refuse collectors,

Concluded on next page

Fig. 4 Glover, Webb and Liversidge 35 cu. yd carrier of the semi-trailer type, used for bulk movement of refuse from a collecting point to a remotely situated rubbish tip. It has roof loading and horizontal load discharge by means of the "Transport" patent moving floor.

Fig. 5 Fore-and-Aft tipping refuse collector made by Shelvoke and Drewry Limited, Letchworth, Herts. The load is compacted by up-ending the body almost vertically as shown, and finally emptied by tipping in the normal manner. A hydraulically-operated Powerpress, hinged to the roof, can be fitted additionally if required.

Pumping Liquids Containing Solids

By J. O. H. Muhlhaus

Holman Bros. Limited

Pumping water and other liquids of similar viscosity presents no difficulties to the manufacturers or operators, except in cases where corrosion problems arise. In such cases special resistant materials may have to be used. Homogeneous liquids of higher viscosity can also be handled, and the performance can be predicted as the relationship between the viscosity of liquid to be handled and friction as is reasonably well known, the main requirement being a higher working pressure.

Rotary types of pumps are available for handling lubricating oils at pressures as high as 1,000 lb per sq. in. New problems have, however, to be faced where unhomogeneous liquids have to be handled, that is liquids containing solid matter in various degrees of concentration, such as the slimes produced in ore-dressing plants or the drilling sludge from the shotholes of a tunnel heading.

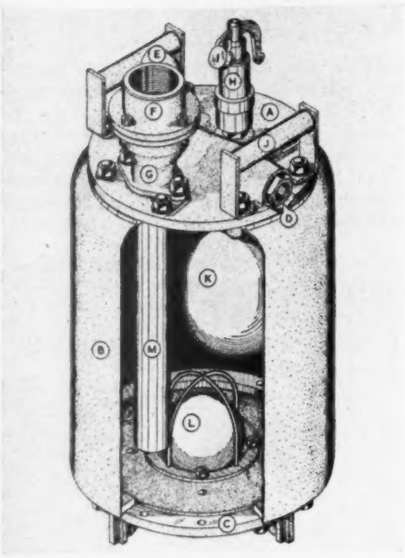
In some cases settling tanks or sumps can be provided in which the mine water, for instance, can be freed from ore or rock fragments. Such fragments would otherwise lead to rapid wear and tear of the pumps. Centrifugal pumps would be especially endangered because wear increases in proportion to the square of the velocity of the liquid containing the abrasive constituents. The great progress made in rubber bonding technique has resulted in an appreciable extension of life for any parts treated in this way, but due to the extra expense, this treatment can only be considered where large quantities of liquid have to be handled. Piston or plunger types of pumps are also faced with the same difficulties, and these become progressively greater as the water content of the slime falls.

Slimes with a low water content and a low specific gravity for the solid matter can be regarded as stable; whereas for sludge, with a larger water content and a high specific gravity of the solid matter, settling may take place and choking may occur, particularly when pumping is stopped. In the latter case higher flow velocities are necessary and greater pipe friction losses are unavoidable.

Two main types of pneumatic pumping plant are available to deal with these conditions, namely the air-lift type and the direct displacement type. In the air-lift type the liquid is aerated and the resulting reduction of the specific gravity of the rising column, assisted by the kinetic energy of the compressed air, raises the liquid. This system, which requires approximately four to five cubic feet of air at atmospheric pressure to lift one cubic foot of water against heads of 150 ft or more, is not very efficient, but has given excellent service for the dewatering of inundated mine shafts and for other similar purposes.

The second system employs one or two chambers into which the liquid is brought by gravity or vacuum, followed by a delivery stroke using compressed air which acts upon the contents of the chamber. The two-chamber method results in a more even flow of the liquid in the rising column, but where the pulsating nature of the flow is no disadvantage, the single chamber method has much to recommend it in simplicity, weight saving and actual costs. The illustration shows a photograph of the single-chamber type of sludge pump. This pump comprises a top cover, main tank and bottom cover assemblies. Within the bottom cover a ball valve is fitted to act as an automatic stop valve.

The operation of the pump is controlled by a float which actuates an air valve in the top cover. This valve opens and closes as the liquid rises and falls within the tank. When the liquid enters the tank the float rises with the level of the liquid in the tank. During this time the air valve in the top cover is opened and air passing from the inlet through this valve to atmosphere, via the ejector, creates a pressure drop within the tank. The level of the liquid in the tank rises until the lever mechanism connecting the float to the valve, closes the valve, thus preventing the air exhausting to atmosphere. Air then pressurises the tank and forces the liquid down, closing the non-return valve. This valve prevents the liquid from escaping through the strainer, therefore its only outlet is the delivery pipe. As the level of liquid falls in the tank the float drops. A time lag mechanism between the movement of the float and valve allows the float to drop a predetermined distance before the air valve opens to recommence the filling process.



A Top cover
B Main tank
C Bottom cover
D Air ejector
E Exhaust air outlet elbow
F Delivery valve cap
G Delivery valve body
H Relief valve
J Lifting handle
K Float
L Inlet non-return valve
M Delivery pipe

Details of Holman single chamber sludge pump assembly.

Concluding **Getting the Best from Cleansing Vehicles**

increasing bulk and decreasing density of domestic refuse has led to the introduction of numerous devices for refuse compaction within the body in order to obtain economic payloads. Such devices include hydraulic compression plates, (see Figs. 1 and 2), tilting bodies, (see Fig. 3), rotating drums and helices. Dustless loading, now making a belated appearance in this country, introduces additional hydraulic or penumatic equipment to operate the bin-emptying mechanism (see Fig. 4). The difficulty of finding disposal sites within city boundaries necessitates the haulage of refuse for long distances to tipping sites, and bulk transporters of up to 40 cu. yd capacity are used for this purpose (see Fig. 5). These machines have power-operated moving floors, or, in the latest type introduced in this country, hydraulic compression rams.

The complexity of such body mechanisms makes regular maintenance essential. Lubrication is a serious problem where refuse is brought into contact with loading or compression mechanism, as dust and ash inevitably become mixed with the lubricant. The steel floors of compression vehicles suffer heavy wear. In some cases a renewable plate is provided in the area swept by the compression plate, and for local patching, alloy "pop" rivets make a quick and durable repair. Mild steel has been the usual material for floors, but tests have shown that low alloy steels such as "Cor-ten," which have greater resistance to abrasion, may be economic despite higher cost.

Vehicles which require special mention are gully-emptiers and road sweeper-collectors. With the former, particular attention should be given to the engine cooling system, as much of the engine's working life is spent driving the air-exhauster pump while the vehicle is stationary. The pump may be air or water-cooled and it is important to ensure that it is protected against the ingress of particles of dirt carried over from the sludge tank. The float mechanism which closes the air extraction valve on the tank should be examined at intervals and the air filter, usually of the wire-gauze type, should be cleaned weekly. Apart from the risk of damage to the pump, choking of the filter imposes higher loads on the engine.

More than any other cleansing vehicle, the sweeper-collector requires regular preventive maintenance, and a trained and conscientious driver is essential for trouble-free operation of this type of machine. Methods of driving have considerable effect on the rate of wear. Coarse use of the clutch can impose severe stress on the broom mechanism; sweeping with excessive broom pressure puts heavy loads on broom gear and engine, which can become overheated. Servicing requires daily washing and greasing of the broom mechanism and regular workshops attention. It is good practice to give this job to one fitter who can become thoroughly familiar with details of the mechanism.

Tyre maintenance is undoubtedly a major problem to transport engineers in the cleansing service. Working daily in congested streets and being thumped against bumper beams, or run over bottles on tips, a life of a tyre or a cleansing vehicle is a hard one. Tyres frequently have to be discarded on account of damage rather than wear. Frequent inspections and checks on pressures are essential. Much can be done by a competent tyre repairer to prolong the life of tyres with relatively simple equipment. Tread cuts can be filled, covers "gaitered" where weakened by punctures, and sidewalls (which suffer particularly from kerbing) can be repaired by vulcanising. Several manufacturers are now producing tyres with additional thickness of rubber on the walls for municipal use.

Like tyres, starter batteries on cleansing vehicles have an arduous life, since low mileages and speeds frequently result in undercharging. A system to be recommended is to have a number of spare batteries in circulation and to change the battery at each vehicle periodic inspection. The battery removed is then put on charge and in turn put in service on another vehicle. The life of batteries can thus be considerably extended. Nickel-iron batteries have given very satisfactory service in cleansing vehicles, their higher initial cost being offset by proportionately longer life and reduced maintenance.

The fleet engineer in the cleansing service may expect metallurgical developments and continued improvements in lubricating oils to result in longer intervals between engine overhauls, replacements of pistons, valves, etc.; but the importance of preventive maintenance will in no way diminish, although the intervals between servicing operations may be extended.

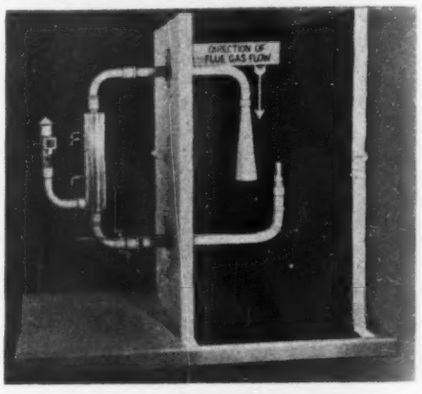
Measuring Dust Burdens in Gases Electrostatically

Continuous indication of the dust content of chimney gases is provided by the new Electrostatic Dust Measuring equipment produced by AEI Electronic Apparatus Division, New Parks, Leicester. It was shown at the National Clean Air Society Exhibition at Harrogate. Such continuous indication could play an important part in future control of air pollution. Already the equipment has been operating satisfactorily in some power stations for several months. It is also helping to provide evidence of the actual dust burden emitted from certain industrial processes.

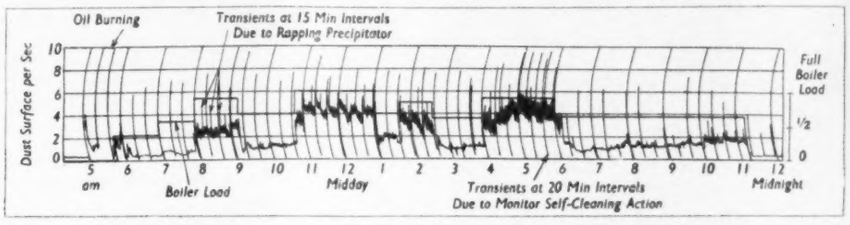
Previously, two methods of determining the quantity of solid matter carried in chimney gas could be used—gravimetric and optical. The first uses a measured sample of the polluted gas, which is filtered and the retained deposit weighed. In the second, the density of the surface area of dust is measured by means of a beam of light projected through the duct or chimney. Thus, the optical method measures dust area per cu. ft rather than quantity passing per sec, which means that a calculation involving flue gas velocity is required before the rate of atmospheric pollution can be determined.

The AEI system overcomes the velocity dependence disadvantage of the optical technique by automatically taking into account the product of particle number, velocity and area. A corona environment is provided in a continuous flowing sample of the gas so that all solid particles become charged, each to an extent proportional to its surface area. The charged particles moving downstream in aggregate form a current proportional to the product of particle number, velocity and area. Amplification of this current enables the pollution rate to be indicated or recorded, or a warning device can be operated if the rate of pollution rises above a pre-set value.

The sort of record obtained is indicated by the chart sample. Start-up periods of the boiler are recorded and flame failure is easily recognisable, as are the outlet rappings of the main precipitators. The small spikes below the load line are an indication of periodic purging of the monitor head.



(Right) By charging the dust and measuring the current flow due to dust movement, a direct indication of pollution rate is obtained.



A sample of the chart record obtained with electrostatic dust measuring equipment.

Mechanised Composting of Sludge and Refuse

By A. G. Davies, M.A.P.H.I., A.M.Inst.P.C.

Chief Public Health Inspector and Cleansing Officer, Woking UDC

There is nothing new in the suggestion of composting household refuse to form a compost of value to agriculture and horticulture; neither is there anything new in the preparation of sewage sludge to form an aid to crop growth. In the past, however, less attention has been paid to the possibilities of disposing of these two waste products of human existence in order to obtain, by mechanised processing, one saleable commodity. Although doubts as to the possibilities of selling the resultant product are used to support the case against what is known as municipal composting, it has to be remembered that waste disposal is a necessary public service and while it is very desirable to sell the end product it is not in fact essential to the prosperity of the process, to be able to do so.

Where municipal composting is concerned it is regrettable that little advantage has so far been taken of the possibilities of incorporating sewage sludge and the nearest location where this is done is in the States of Jersey. Here the two plants for refuse and sewage disposal are built on the same site and the composting process is being used for the solution of the sludge disposal problem. It is difficult to understand why this position has arisen because sewage sludge disposal has become a major problem to all but the few authorities already well known for their exploitation of the possibilities in this direction. Applied in correct quantities sewage is beneficial to the end product of a domestic waste composting operation.

DEWATERING

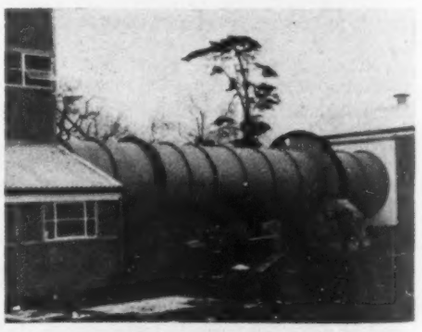
Practical difficulties do of course exist. Composting installations are not always sited in close proximity to the sewage works and any form of transport of sludge other than by pipeline would prove expensive. It is inevitable, therefore, that some form of dewatering has to be considered and little research has so far been applied on the relationship between sludge dewatering and the other problems of mechanised composting.

For the most part, windrow composting makes demands upon land resources and labour which are sufficient to render the method impracticable in this country except in certain isolated circumstances. There are two established mechanical methods now in use in this part of the world and without doubt the industrial interest now being occasioned will tend to encourage the introduction to this country of one or two other methods practised on the Continent and perhaps elsewhere.

The new plant at Leatherhead operates on the Dano Bio-stabiliser principle and it is intended that sewage sludge shall be introduced eventually. The refuse tailings from the salvage sorting section discharge via a conveyor belt to the stabiliser, together with a proportion of fine dust. The stabiliser drum rotates slowly, and as the refuse enters, sewage sludge is injected by pump. During this process, which takes about five days, the materials are evolved as compost by fermentation and the self-grinding and abrasive action obtained by the mass of material in rotation. Air is introduced by several air valves on the longitudinal axis of the stabiliser by a small air pump. The material, by the biochemical action and temperature rise is reduced to an innocuous friable condition and is then conveyed to the final separation building. The Leatherhead plant assumes an additional importance to composting interests in this country because it is the first installation to deal with the arisings from the *whole* population of an individual authority.

At Jersey an entirely different approach is made to the process, the composting being achieved by a series of rotatable fermentation cells situated one above the other. The mixed wastes are hoisted to the first of the fermentation cells, which consist of six platforms in the form of a tower. The wastes are spread on the floor of the first platform to a depth of 3 ft and remain there for 24 hours before being transferred to the platform below. At the bottom, the partly composted material is removed to open sheds for maturing purposes.

There is plenty of controversy concerning the possibilities of municipal compost, but the main criticisms can be brought to three classifications—possible odour during processing, glass elimination, and sales possibilities. The first and second of these are challenges to engineering ability and indeed because of progress already made, neither can be considered anything but a transient problem. It has already been proved that a stable product resistant to climate is readily obtained and with cooperation between engineering and sales techniques the future must be assured.



Biostabiliser at Leatherhead designed for municipal composting of sludge and refuse. The process takes about five days, the compost evolving by fermentation and the self-grinding and abrasive action of the rotating materials.

Dustmen in White

REFUSE collection, free from dust and smells, and carried out quickly with a minimum of attendants, must surely be the ambition of every local authority entrusted with this task. A three-month trial, conducted by the Rural District Council of Swale, near Sittingbourne, Kent, has shown that such a result may be obtained by the substitution of paper sacks, suspended from metal holders, fitted within the normal dustbin.

Paper sacks have, in fact, been used in Scandinavia and other parts of Europe as domestic refuse containers for over seven years. Those employed in the trial at Swale were Multiwall paper sacks, supplied by Reed Medway Sacks Limited, of Larkfield, near Maidstone, Kent, a member-firm of the Reed Paper Group. These sacks are constructed of two plies of wet-strength kraft paper. Refuse weighing up to as much as 70 lb may safely be deposited in these bags and they will accommodate tins, bottles and soggy vegetable wastes without being damaged.

The trial was carried out at 520 premises, the extent of a full day's collection for one vehicle in a rural area, and not one sack out of more than 6,000 used in the experiment is reported as having failed, in spite of broken glass and the jagged edges of empty tins. Very hot cinders, placed in one or two of the sacks in error, did no more than cause scorching and the bags held without losing their contents, notwithstanding this damage.

Initially, sack holders of various kinds were tried and, as a result of modifications, dictated by experience, two types have been evolved. These comprise a wall-mounted model costing about £1 10*s* 6*d* each and a free-standing model, illustrated in Fig. 1, costing about £2 10*s* each. Both models are being manufactured under licence by Cartem Engineering Limited, of 40a Dover Street, London, W1. The wall-mounted holder, shown in Fig. 2, can be affixed to almost any type of wall in a few minutes with the aid of a cartridge gun.

The Medway-Cartem system is quite simple. A paper sack is slipped over a holder, and secured by two metal arms clipped together in the front of the holder. Both types of holders have hinged lids, shown open in Fig. 1 and closed in Fig. 2. The lids are supplied with handles for lifting and close on to rubber rims, which lessen noise and ensure a close fit. It is only necessary to lift the lid when something has to be deposited in the sack. When the dustman calls, he brings a new sack, which he places under the lid of the holder, and removes the full one, the neck of which he twists, so that refuse and smells are both securely contained. The sack, together with the refuse it holds, is then tossed into the dustcart, as shown in Fig. 3. It is the householder's duty to fit the new sack into the holder.

The experiment was carried out as a result of the Swale Rural District Council deciding to adopt backdoor collection methods in place of the kerbside collection which had been in operation for many years in the area. The latter system, however, has always been regarded by public-cleansing authorities generally as a method having definite shortcomings. For one thing, it is inconvenient to householders, especially to elderly people and invalids unable to carry heavy dustbins from their houses to the kerbside.

It was felt that the introduction of a backdoor collection would be of benefit to everybody, and accordingly, both the paper-sack and skip systems were investigated. The skip system is also considered to possess disadvantages: dustman fatigue, for example, through the men having continually to lift the metal skip and dustbins (amounting to some 2½ tons a day), lack of hygiene and general untidyness when the contents of the bins are emptied, first into the skips and then into the dustcart. In both methods, consolidated refuse is often difficult to empty cleanly. Banging the bins is necessary and this causes damage to their rims. The resulting ill-fitting lids give easy access to flies and wasps and allow all the smells to escape.

The paper-sack system achieves almost dustless collection and loading. Indeed, the Swale men were able to wear white overalls on duty and these were surprisingly little soiled at the end of the day.

Fig. 1 The free-standing holder. The sacks have an effective depth of 3 ft and a circumference of 3 ft 6 in.

Fig. The fixed model, showing an empty sack under the lid.

Fig. 3 A "full" sack being placed in the collecting van. The upper part of the vehicle contains the supply of new sacks.

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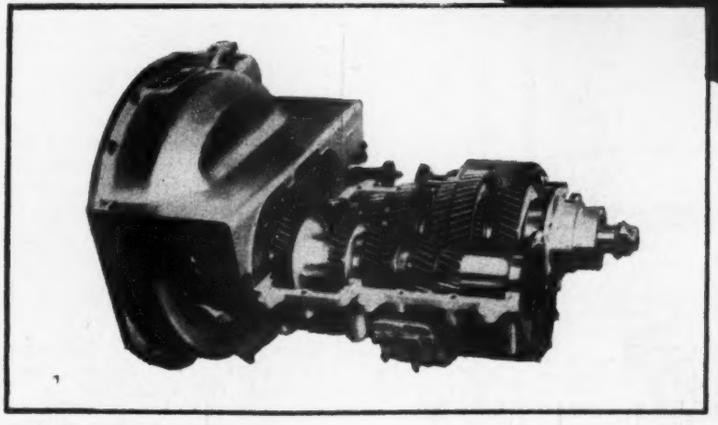

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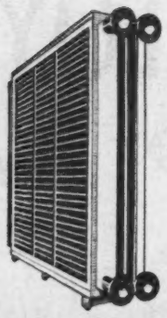

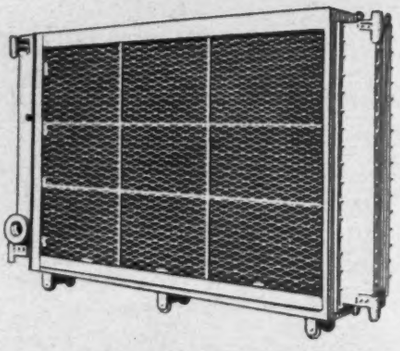

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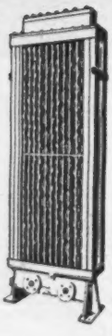

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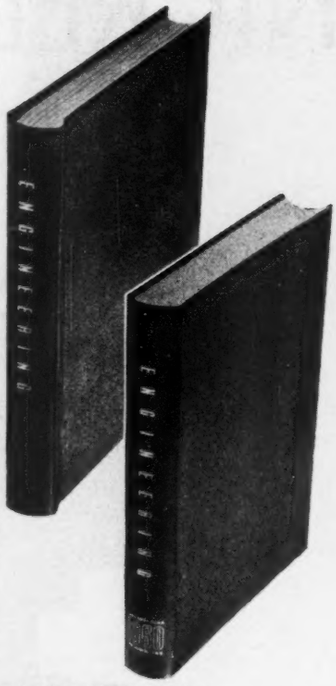

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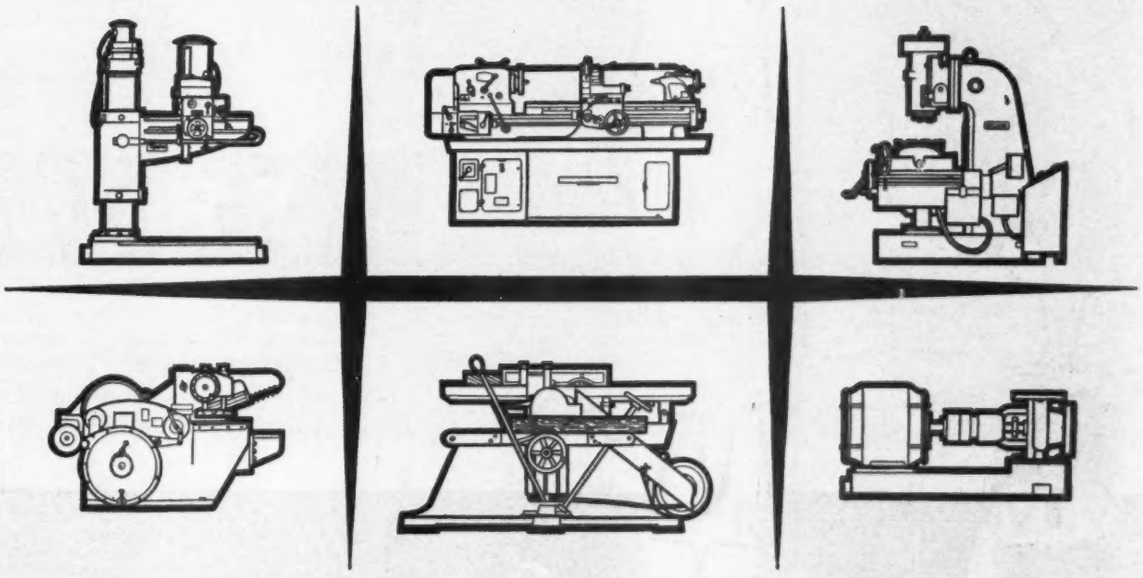

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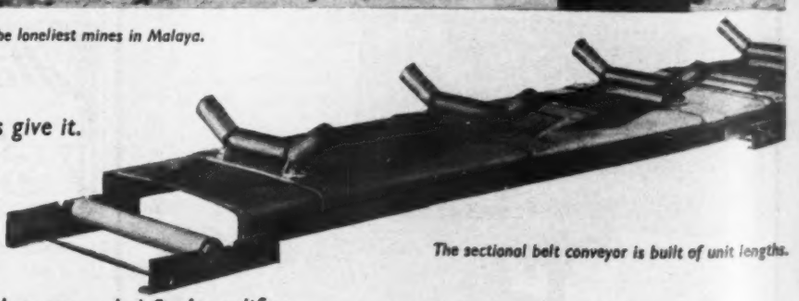

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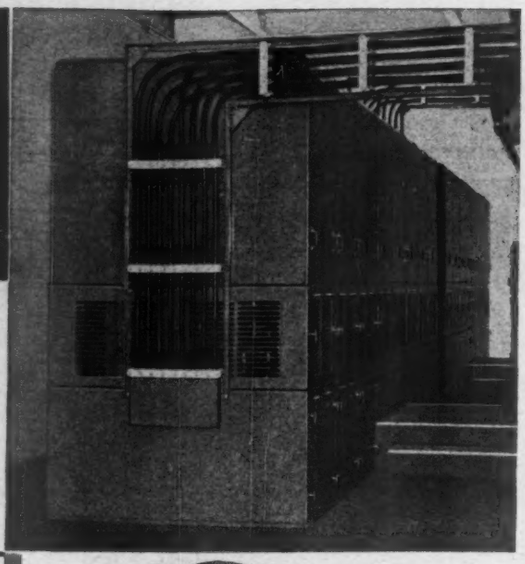

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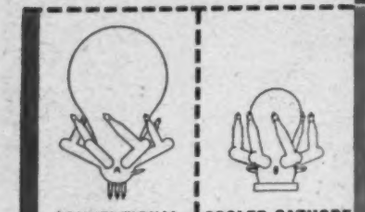

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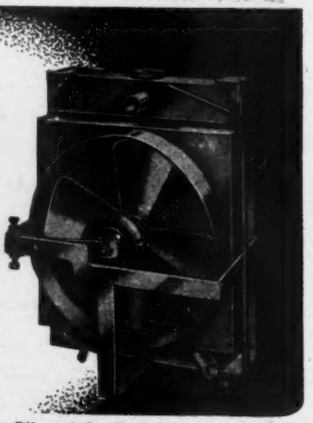

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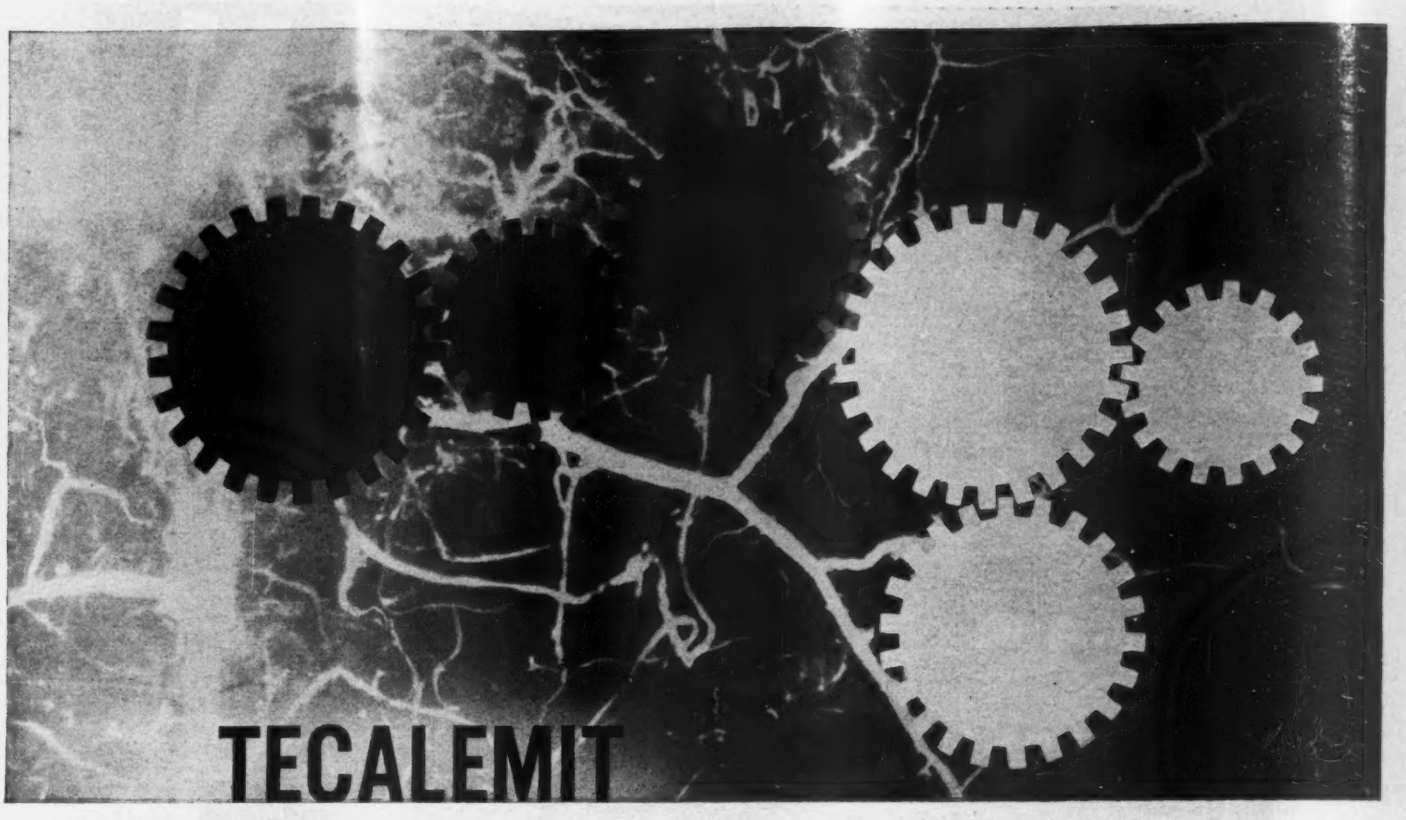

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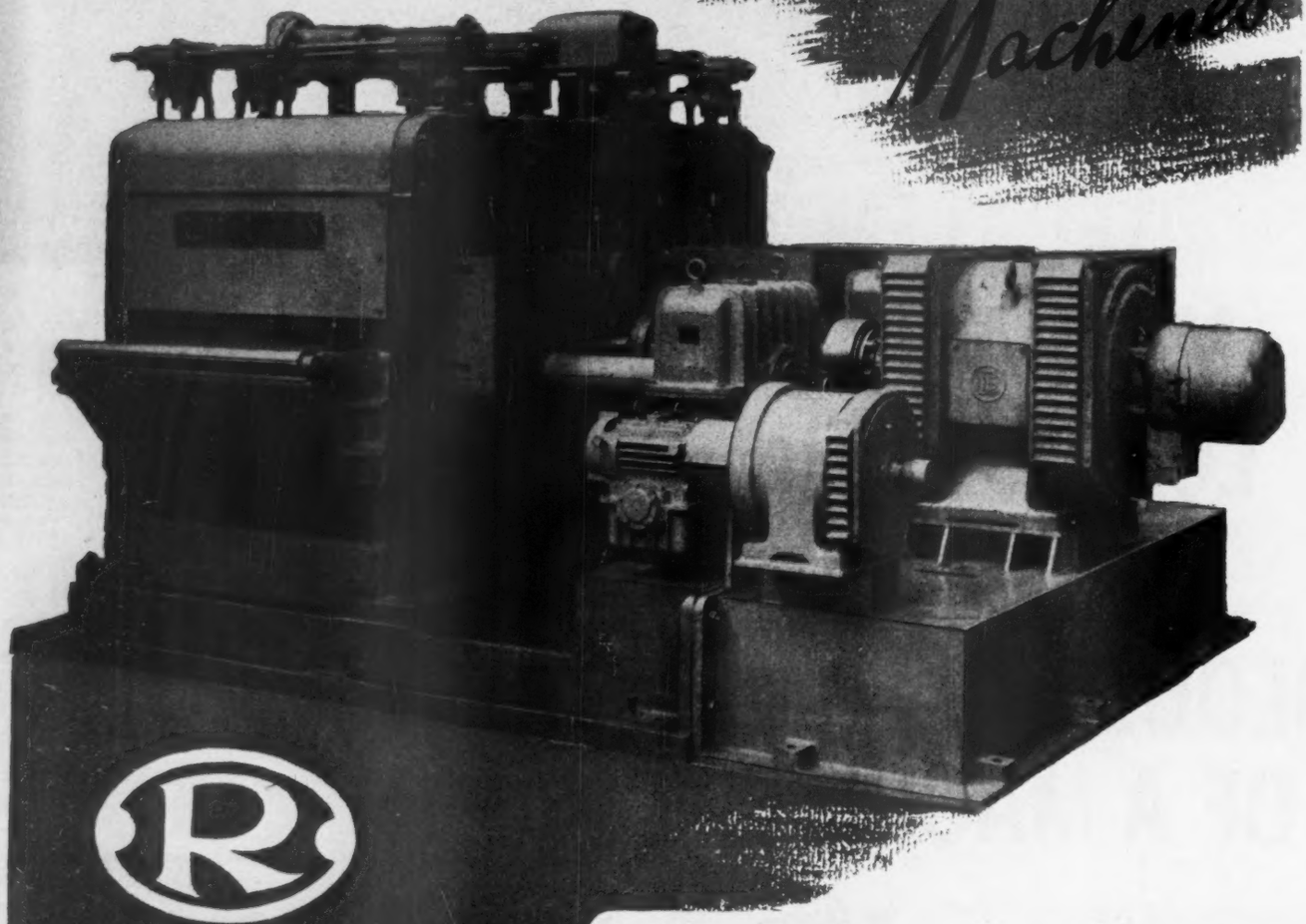
ROBERTSON

SLAB Milling Machines



Depicted above is a No. 1653 Torrington Slab Milling Machine for overhauling non-ferrous strip up to 30 in. wide and $\frac{3}{4}$ in. thick, milling one face at a time.

The cutting speeds are variable up to 45 ft./minute dependent on the material and general requirements.

W. H. A. ROBERTSON & CO. LTD., BEDFORD, ENGLAND

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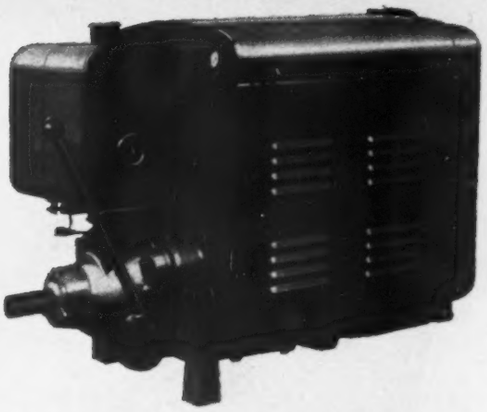
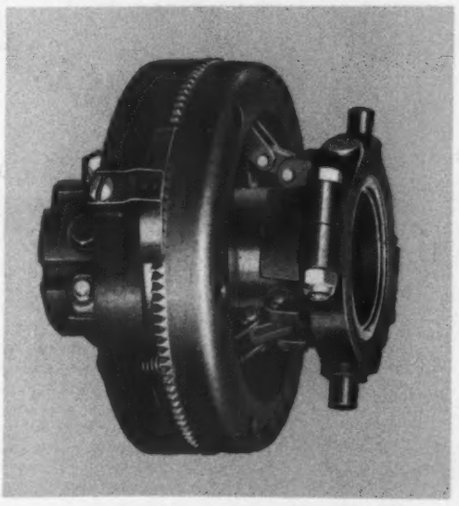
Newage (Manchester) Ltd. supplied their Newage B.M.C. 2¼ litre power pack and pumping equipment, which can deliver at the rate of 750 gallons per minute.

Illustrated at right:
Above: The Newage B.M.C. power pack
Below: The 5½-inch over-centre clutch fitted to the power pack





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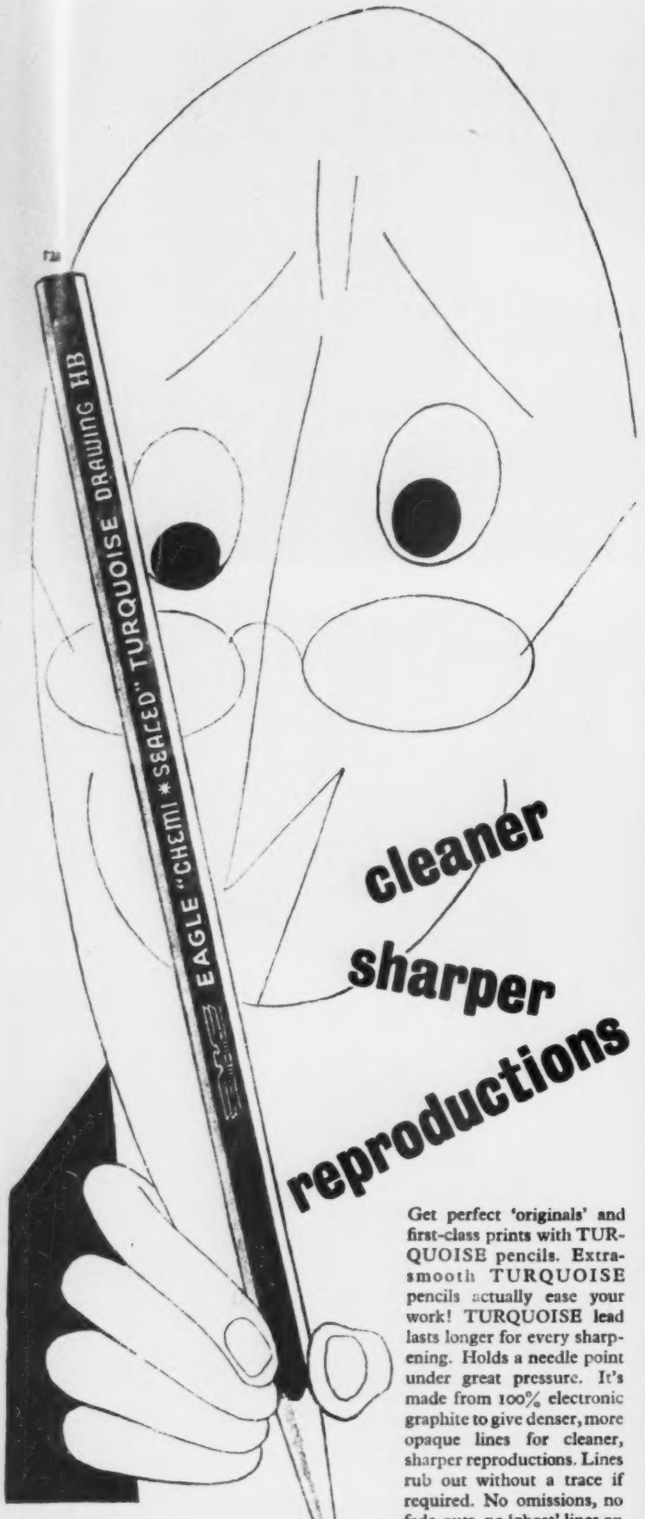

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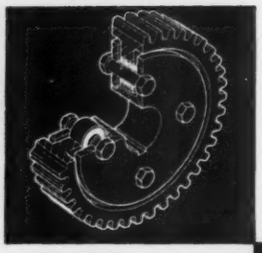
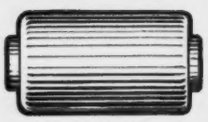


MORE AND MORE
DAY BY DAY



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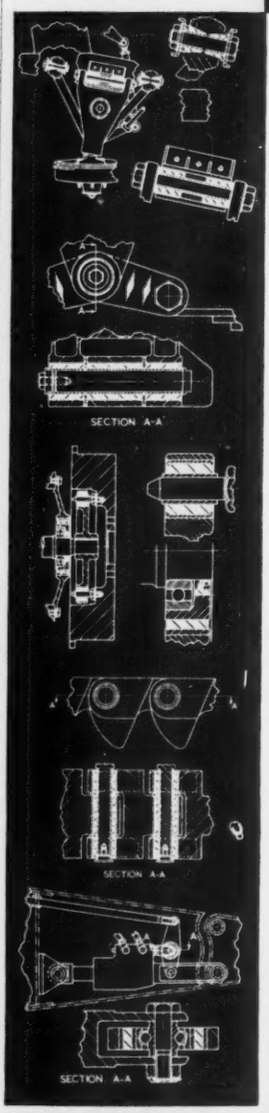

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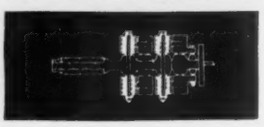

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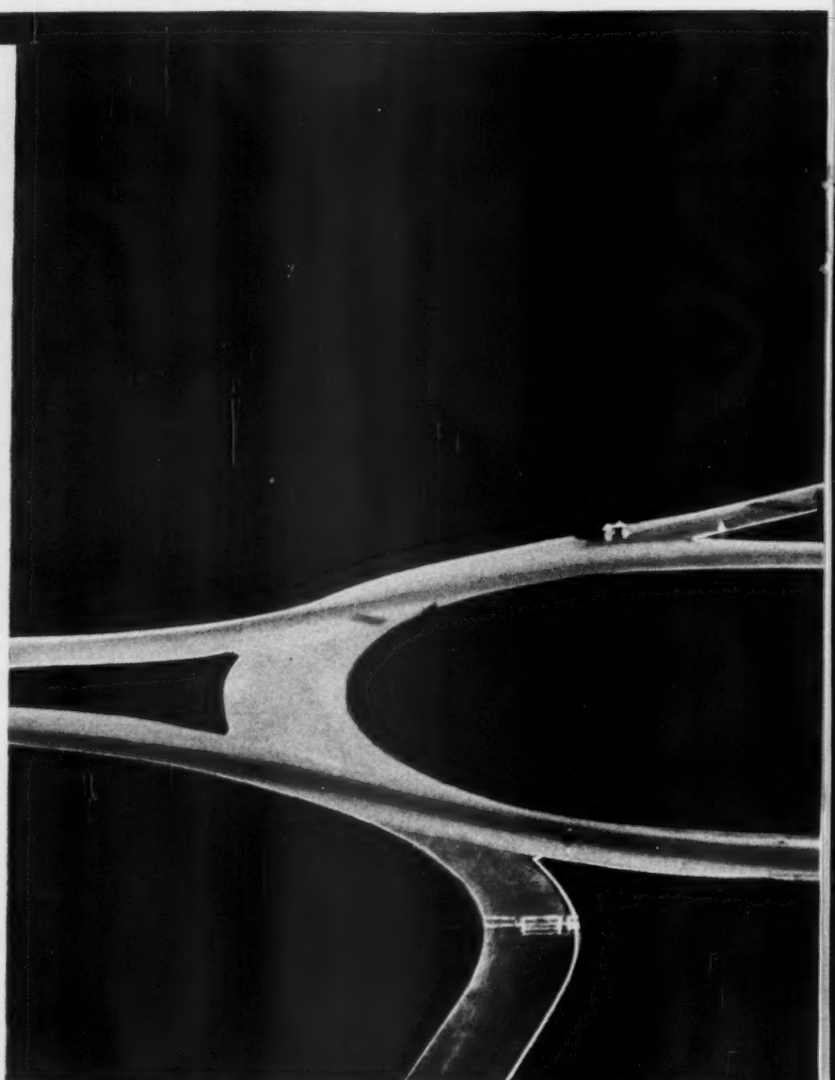
Photograph by courtesy of Messrs. John Laing and Son Ltd.



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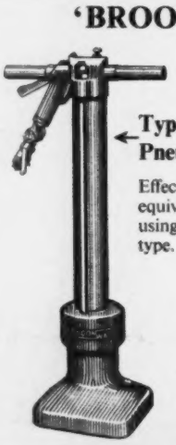

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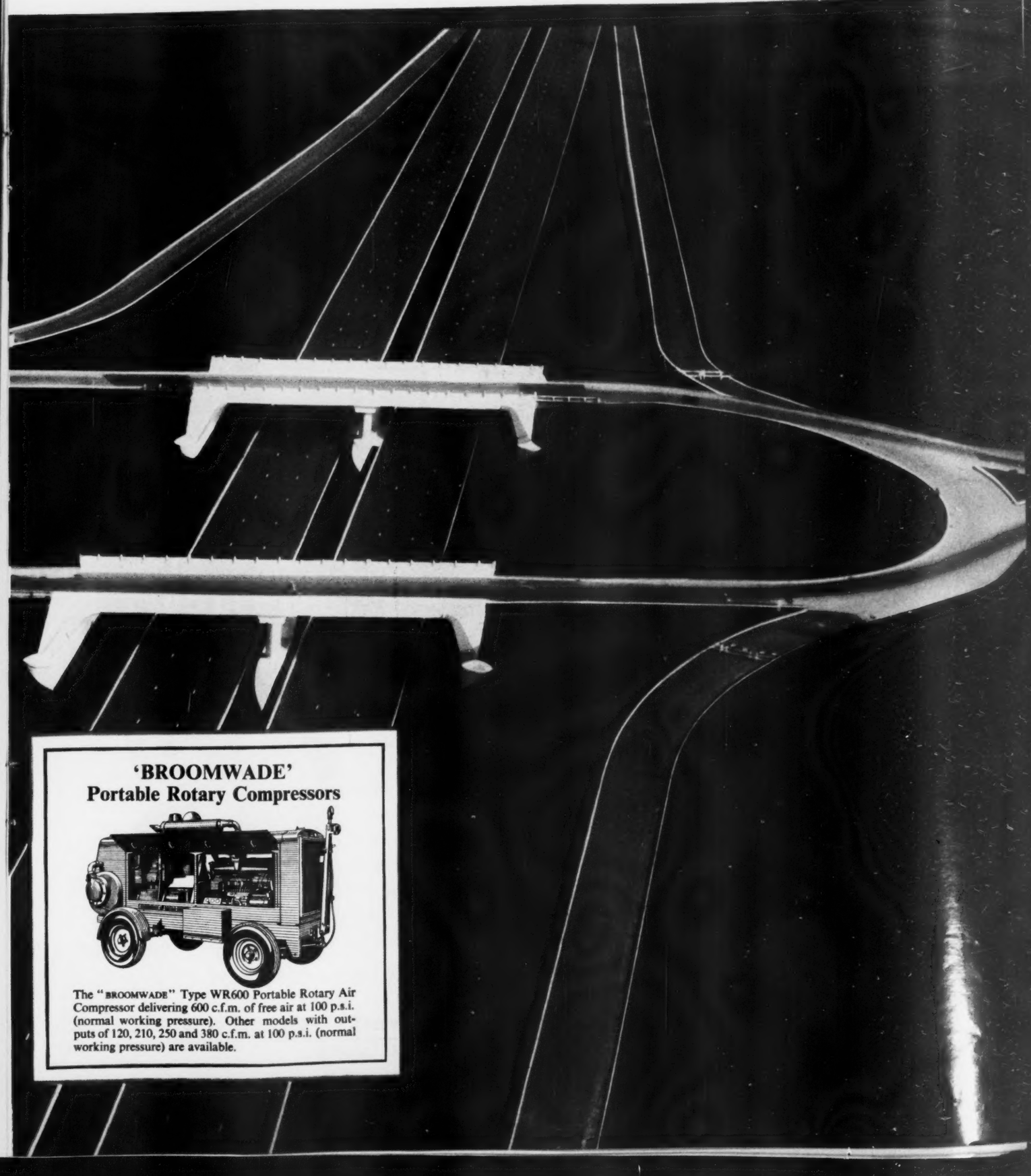

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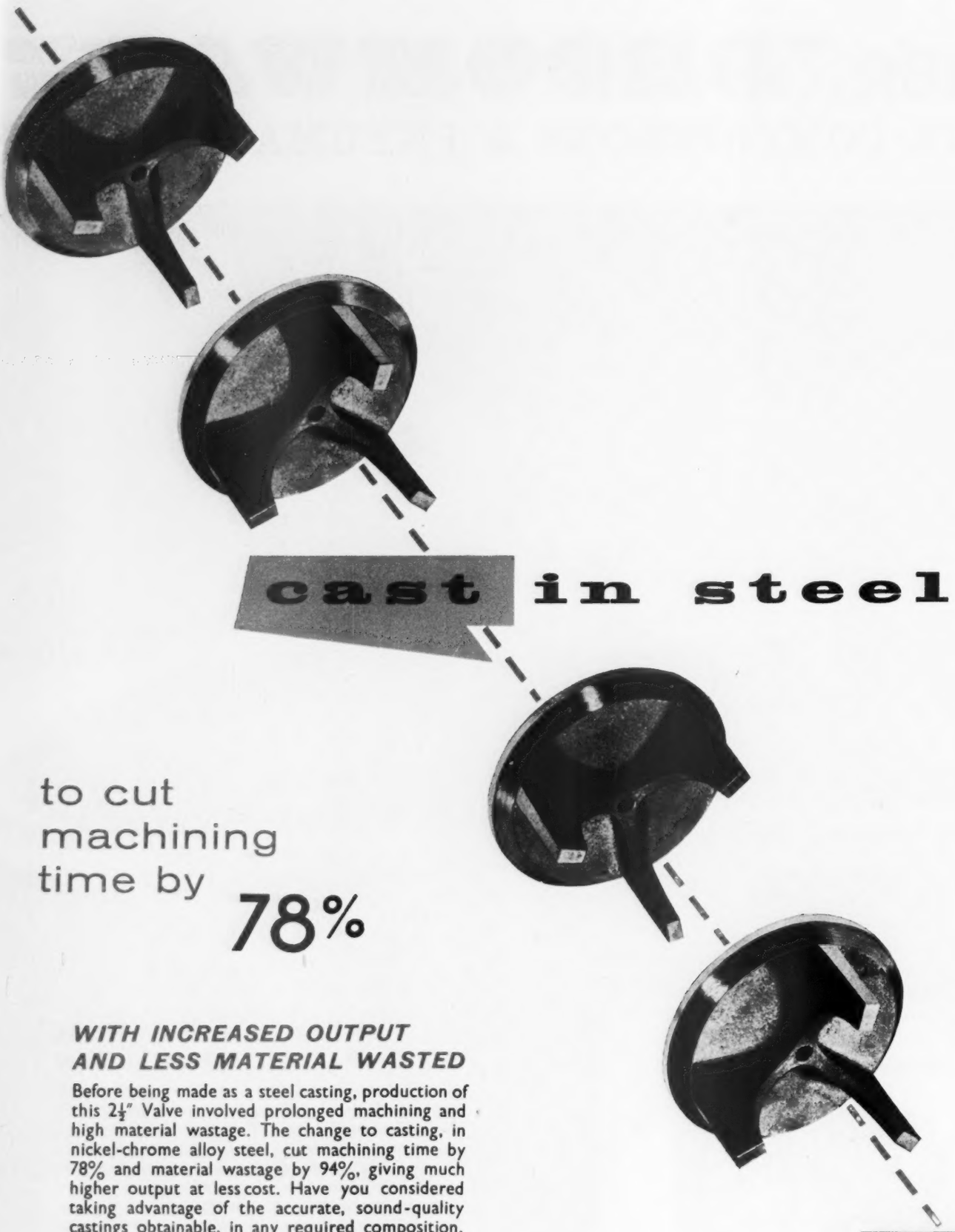
The "BROOMWADE" Type WR600 Portable Rotary Air Compressor delivering 600 c.f.m. of free air at 100 p.s.i. (normal working pressure). Other models with outputs of 120, 210, 250 and 380 c.f.m. at 100 p.s.i. (normal working pressure) are available.



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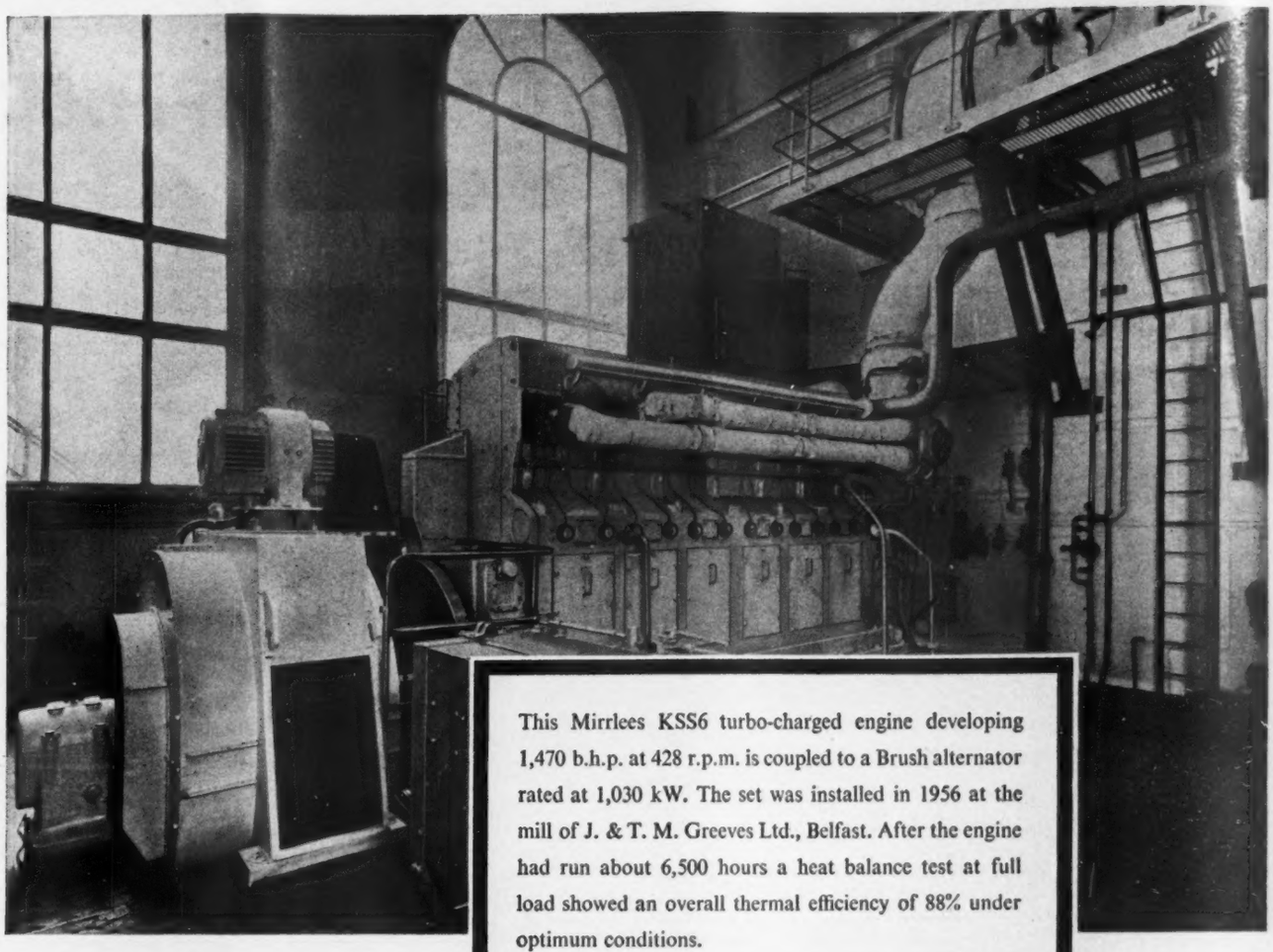

This Mirrlees KSS6 turbo-charged engine developing 1,470 b.h.p. at 428 r.p.m. is coupled to a Brush alternator rated at 1,030 kW. The set was installed in 1956 at the mill of J. & T. M. Greeves Ltd., Belfast. After the engine had run about 6,500 hours a heat balance test at full load showed an overall thermal efficiency of 88% under optimum conditions.

THERMAL EFFICIENCY 88 per cent

achieved by Mirrlees diesel generating plant with "Latent Heat" cooling and exhaust heat recovery

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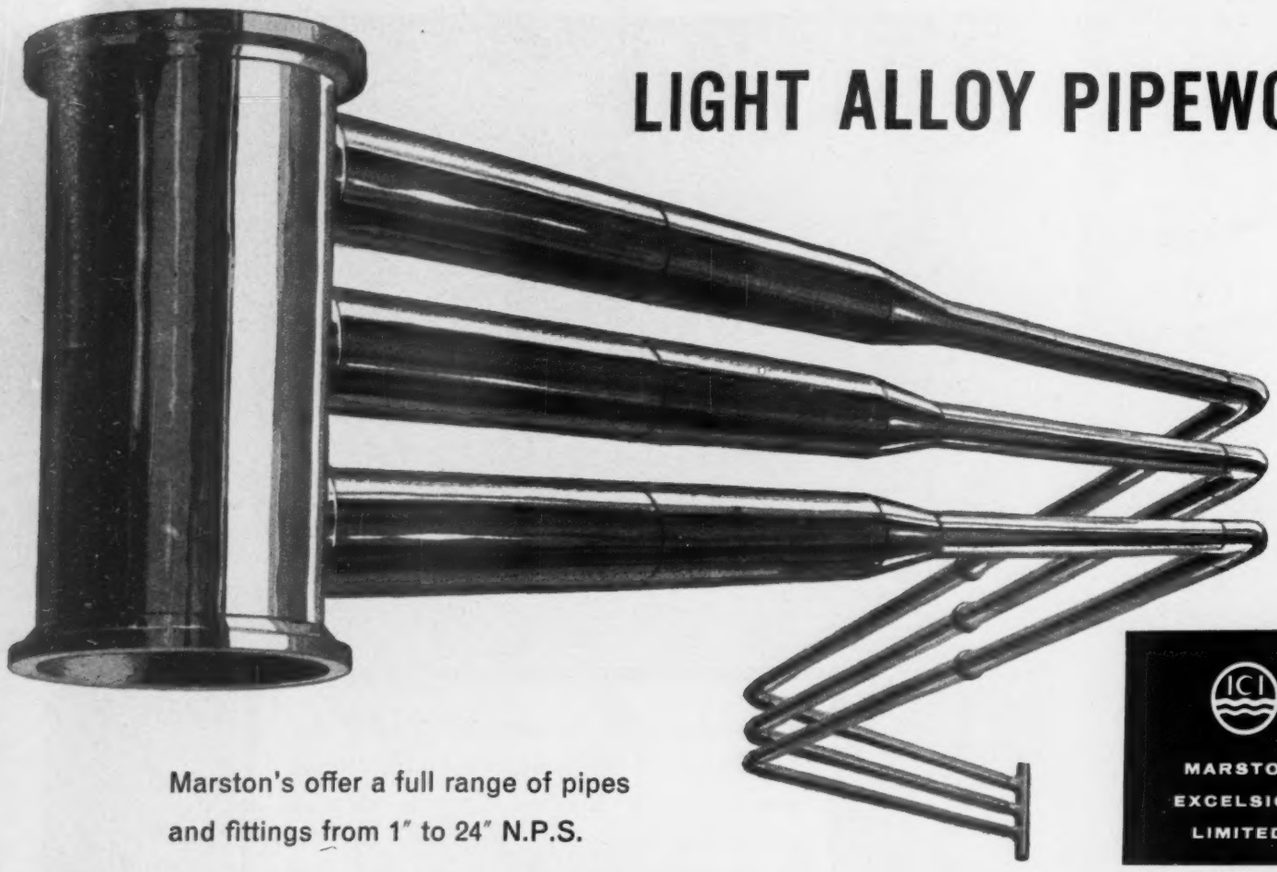

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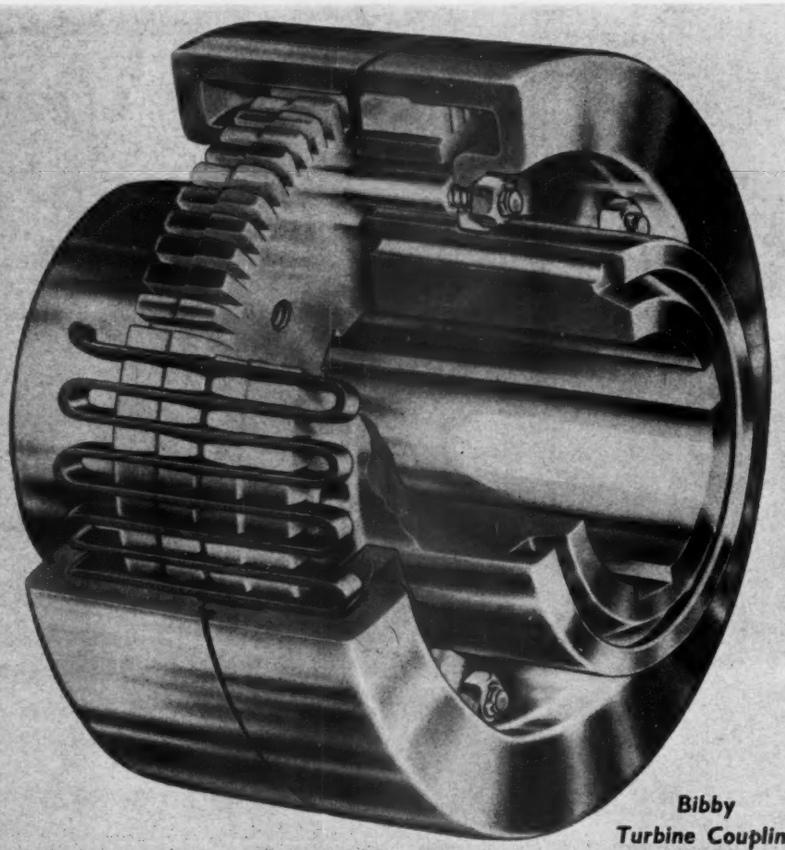
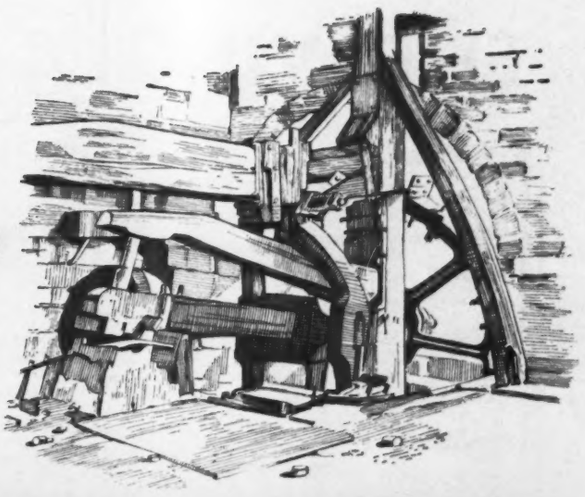
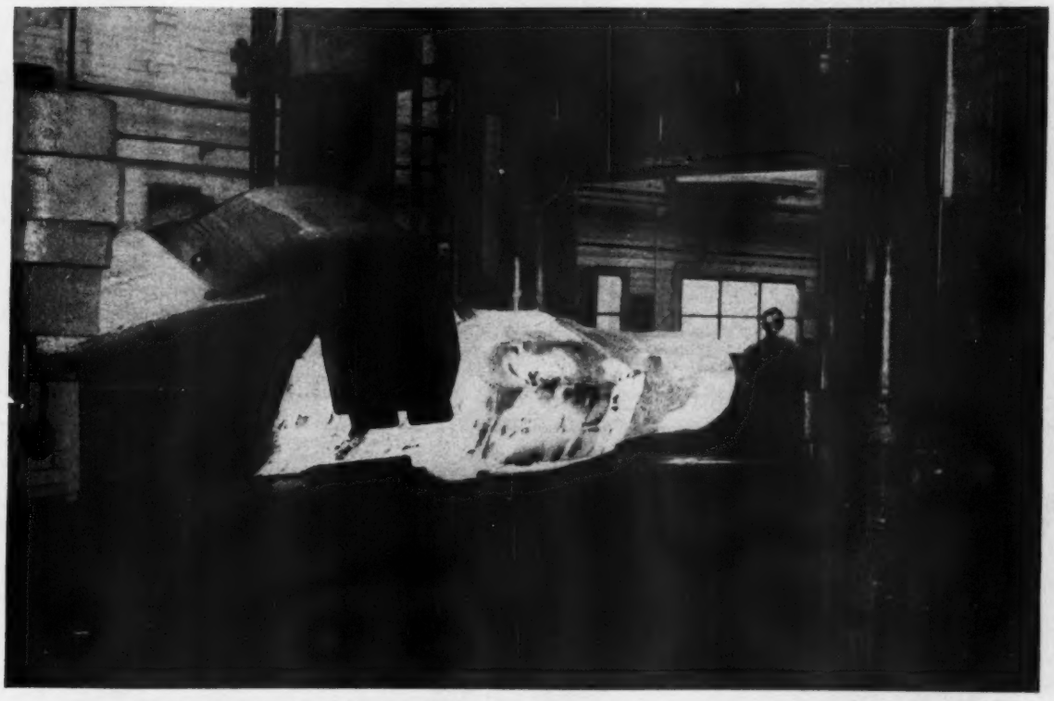


Bibby Turbine Coupling

THE WELLMAN BIBBY COMPANY LIMITED, PARNELL HOUSE, WILTON ROAD, LONDON, S.W.1

Steel in Both the Sixties





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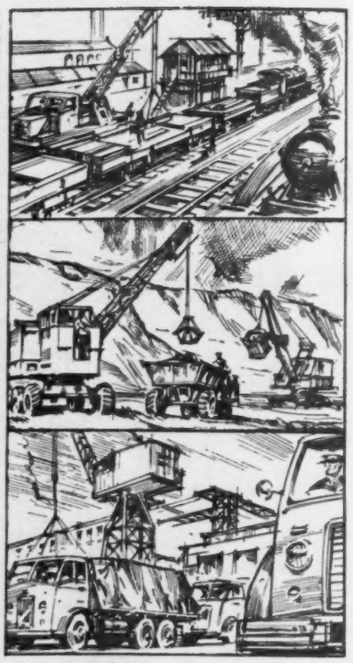

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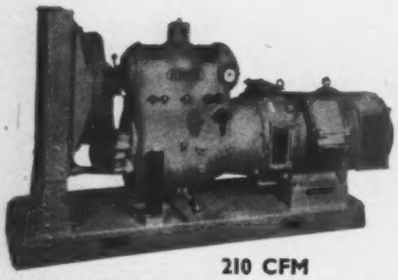

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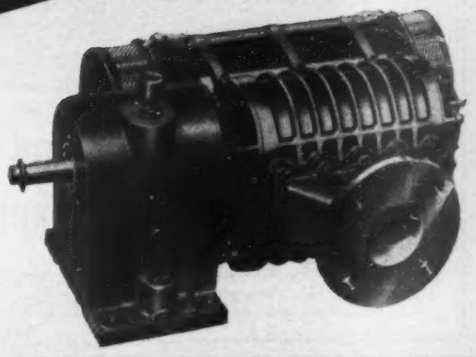
Speed rpm	Airflow cfm	Pressure psi
1500	75	2
3000	150	7

K-300

Speed rpm	Airflow cfm	Pressure psi
1500	100	5
2900	200	10



L-675

Speed rpm	Airflow cfm	Pressure psi	
1500	100	5	*
2750	450	10	*
1500	200	5	†
2750	400	12	†

* available with 2 : 1 step up gear

† carbon seals, continuous duty. Also available for pressures up to 15 psi, intermittent duty.

M-2000

Speed rpm	Airflow cfm	Pressure psi
1500	750	3
2200	1000	10

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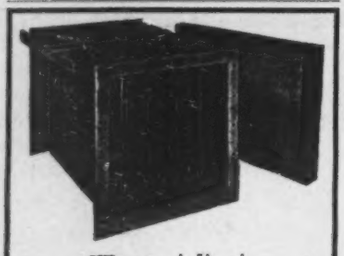
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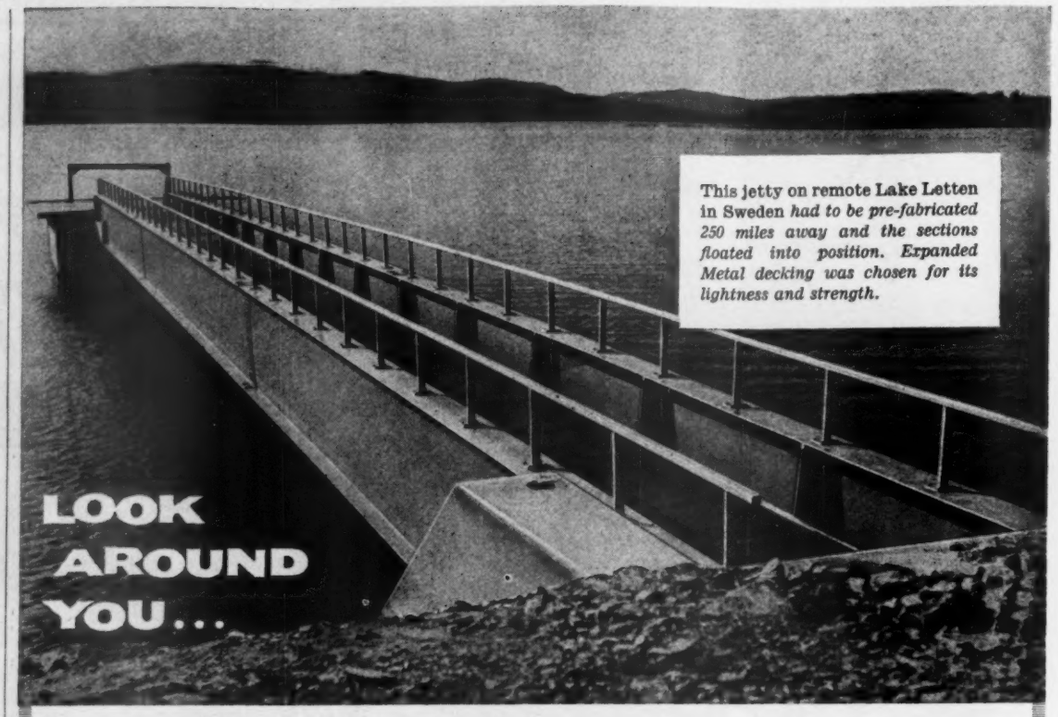
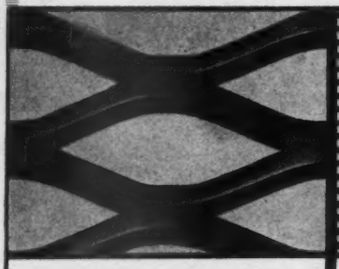
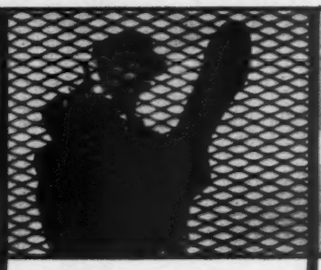


This jetty on remote Lake Letten in Sweden *had to be pre-fabricated 250 miles away and the sections floated into position. Expanded Metal decking was chosen for its lightness and strength.*

and see that on catwalks, walkways and decking Expanded Metal* provides the best solution at lower cost

* In steel or spark-free Aluminium


Expanded Metal is Lighter
Because of the exclusive way it is made, Expanded Metal is actually appreciably stronger than the solid sheet from which it is originally engineered.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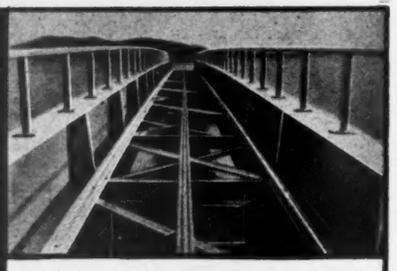
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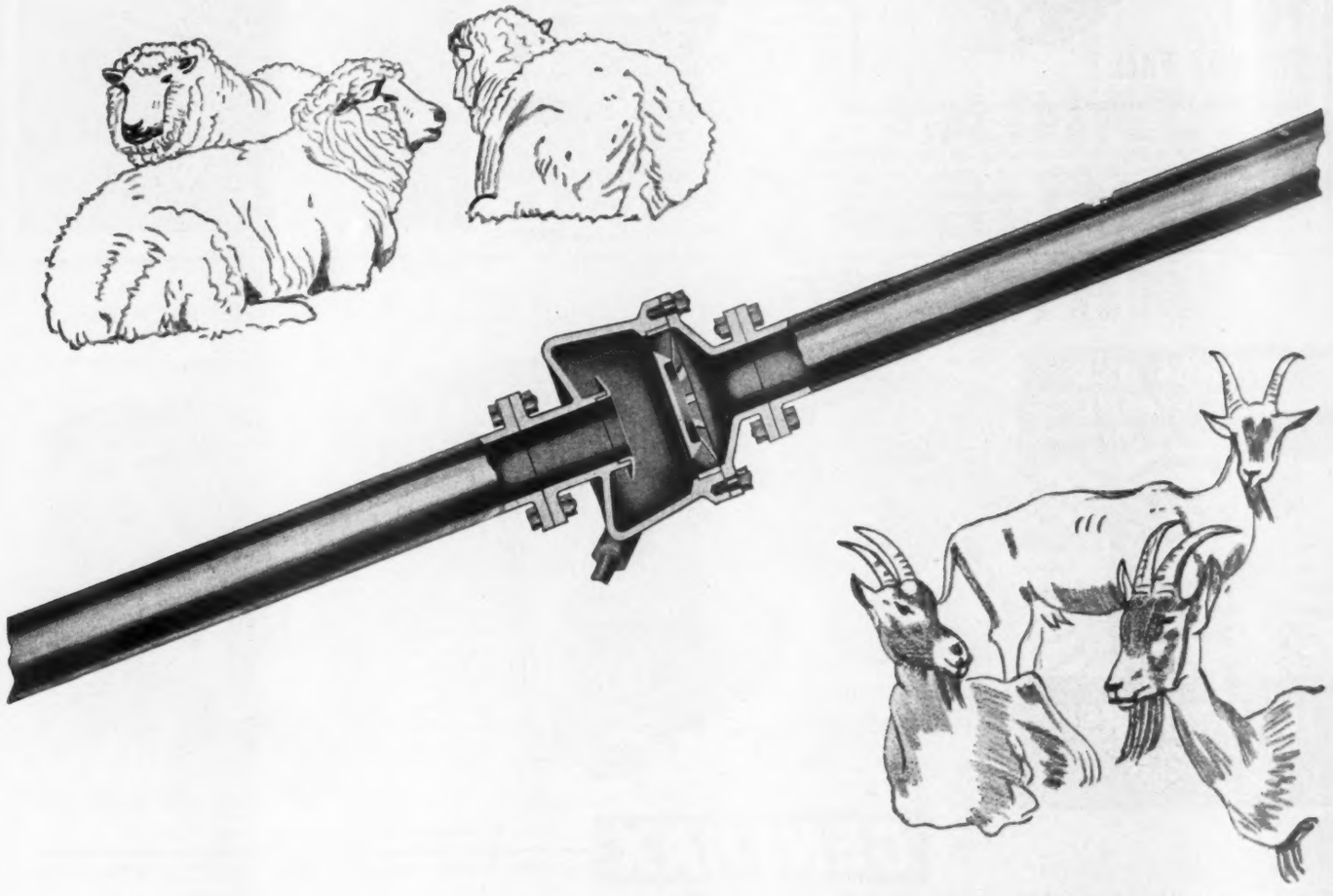

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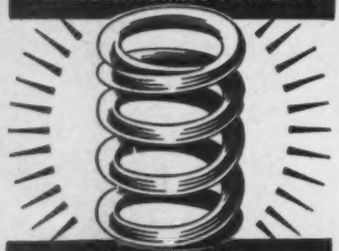

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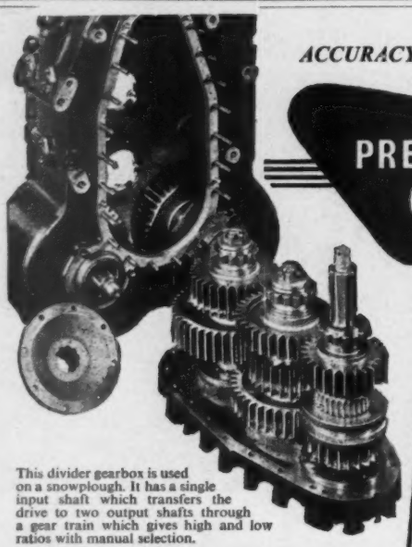

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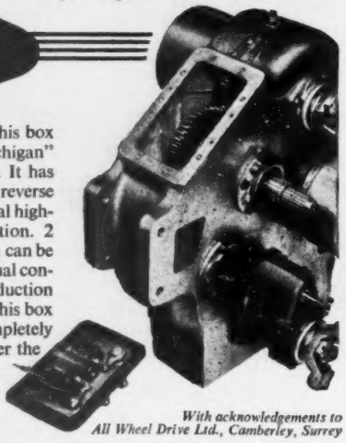

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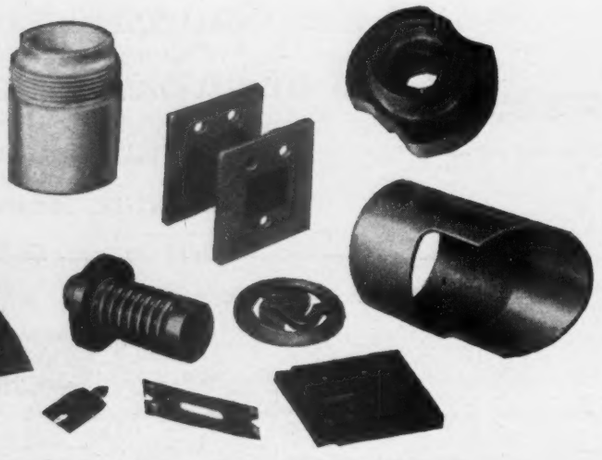

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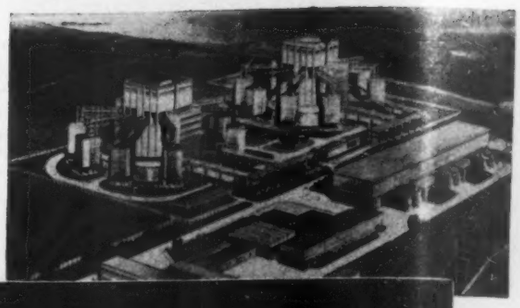

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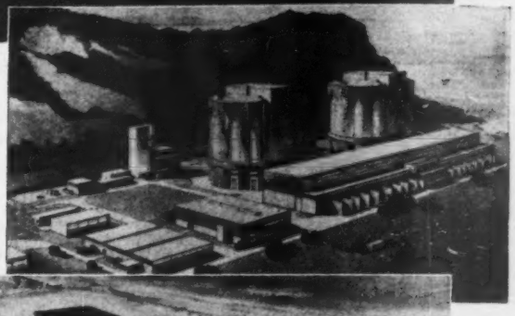

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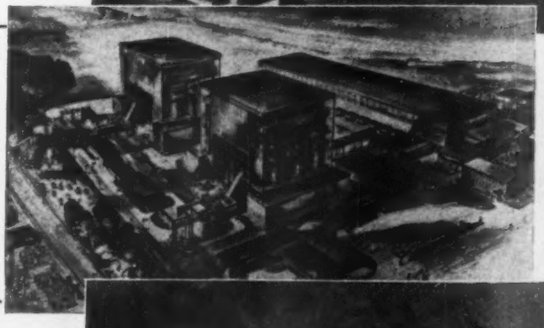

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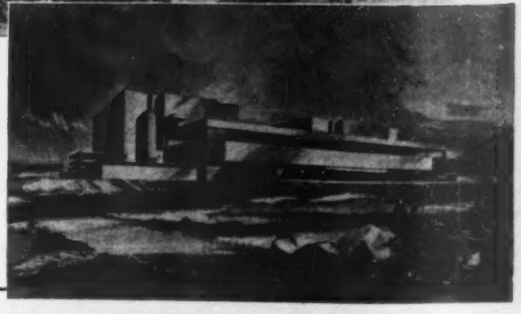
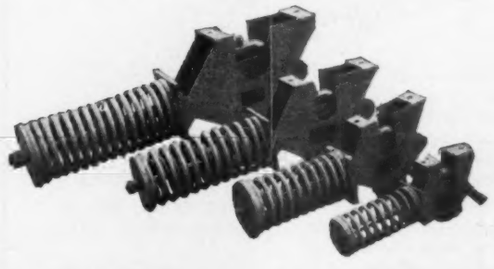
TRAWSFYNYDD (Atomic Power Constructions Ltd.)
(An impression by Sir Basil Spence, Consultant Architect to Nuclear Civil Constructors, showing how the design blends into the landscape of Snowdonia)





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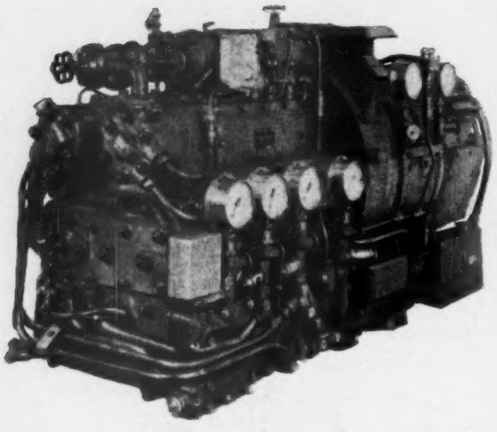

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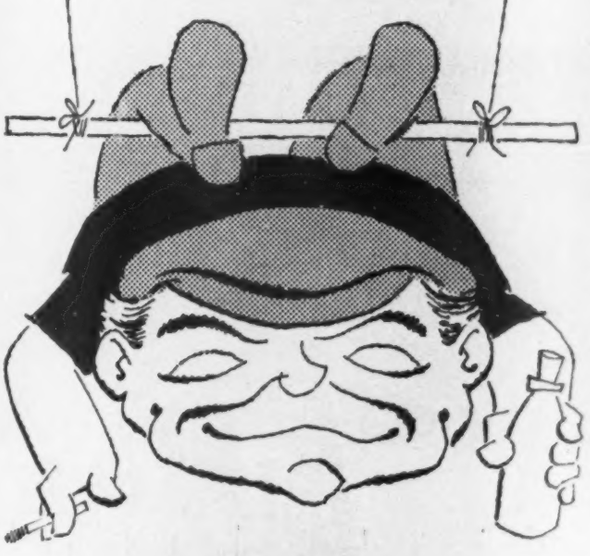

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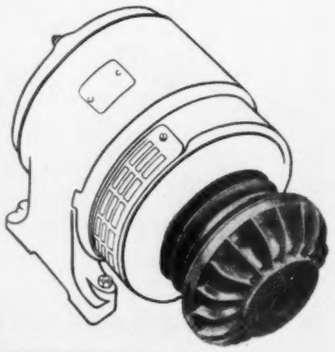

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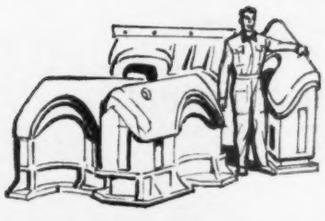

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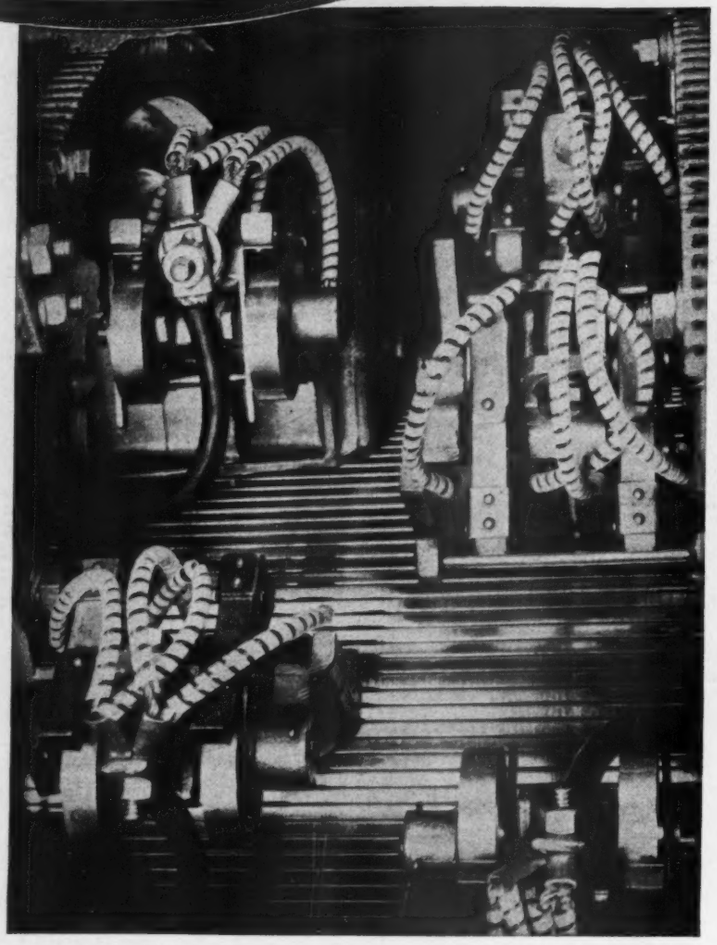

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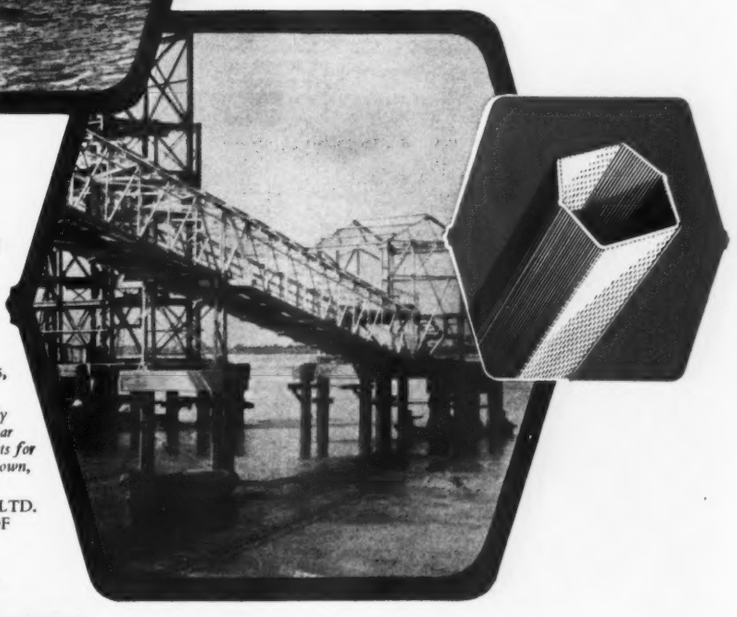

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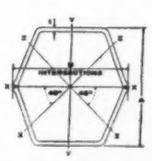

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"Rendhex" Column No.	Size (Ins.) A	B	t	Weight of Rolled Section lbs. per Lin. ft.	Weight of complete Col. (incl. Weld) lbs. per Lin. ft.	Area of complete Col. (excl. weld) Sq. ins.	Moment of Inertia (Ins⁴) About XX	About YY	About ZZ	Radii of Gyration (Ins.) About XX	About YY	About ZZ	Section Moduli (Ins.³) About XX	About YY	About ZZ
No. 3	13	12⅞	½	36·15	72.50	21·26	469·3	381·3	425·3	4·69	4·23	4·47	72.20	58·70	57·30
No. 4	16	16⅛	½	58·30	117·75	34·30	1214	1038	1126	5·95	5·50	5·73	151·75	125·82	116·15
No. 6	20	20	0·7	80·70	162·80	47·47	2657·7	2203·5	2430·6	7·49	6·81	7·16	265·80	218·60	207·20

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